EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES

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I hereby declare that the thesis entitled "**EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES**" submitted towards partial fulfillment of the requirements for the award of **MD in ANAESTHESIOLOGY** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Anju Grewal,** Professor & Head, Department of Anaesthesiology, **Dr. Mirley Rupinder Singh**, Professor, Department of Anaesthesiology, & **Dr. Rajnish Garg,** Professor & Head, Department of Orthopaedics. No part of this thesis has formed the basis for the award of any degree previously.

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Dedicated

to

my Family

&

Teachers

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Dr Megha Sood

ABBREVIATIONS

AIIS	Anterior inferior iliac spine
AON	Accessory obturator nerve
CNB	Central neuraxial block
EOSP	Ease of spinal positioning
FICB	Fascia iliaca compartment block
FN	Femoral nerve
FNB	Femoral nerve block
GA-LMA	General anaesthesia with laryngeal mask airway
GETA	General anaesthesia with tracheal intubation
IPE	Ilio-pubic eminence
LA	Local anaesthesia
LFCN	Lateral femoral cutaneous nerve
LIA	Local infiltration analgesia
NRS	Numerical rating scale
NSAID’s	Non-steroidal anti- inflammatory drugs
ON	Obturator nerve
PACU	Post anaesthesia care unit
PCA	Patient controlled analgesia
PENG	Pericapsular nerve group block
PNB	Peripheral nerve block
PRISMA	Preferred reporting items for systematic reviews and meta analyses
THA	Total hip arthroplasty
USG	Ultrasound guidance
VAS	Visual analogue scale

ABSTRACT

Introduction: Hip fracture is a common orthopaedic emergency in the elderly associated with significant pain. The anterior hip capsule is innervated by the Femoral nerve (FN), Accessory Obturator nerve (AON) and Obturator nerve (ON), and hence these nerves should be the main targets for analgesia. The peri-capsular nerve block (PENG) has reported ability to block the FN, ON and AON at the same time thereby decreasing pain and minimizing the use of opioids in post-operative period.

Aims & objectives: The analgesic efficacy of this block needs validation in randomised control trials. We hypothesised that varying volumes of local anaesthetic solution in PENG block can alleviate post-operative pain at rest and on dynamic hip movement due to its motor sparing properties.

Material & Methods: A prospective, double blind, randomized study was conducted on 70 adult patients of ASA- I, II, and III undergoing hip hemiarthroplasty, total hip arthroplasty and CC screw fixation (DHS) under general anaesthesia with tracheal intubation (GETA) or general anaesthesia with laryngeal mask airway (GA-LMA). Enrolled subjects were divided into 2 groups A and B to receive either 20ml of 0.2% Ropivacaine or 10ml of 0.2% Ropivacaine respectively in an ultrasound guided (USG) PENG block. The block was performed under USG using a high frequency curvilinear probe with patient in supine position by an experienced anaesthesiologist after administration of general anaesthesia. Duration of pain relief and VAS scores were recorded as primary outcome measures, with patient satisfaction scores and cumulative amount of rescue analgesic needed in 24-hour post-operative period as our secondary outcomes. Data thus collected was statistically analysed.

Results: Mean duration of analgesia was significantly prolonged in group B as compared to group A with statistically significant decreased VAS scores at rest and on dynamic hip movement in group B. Median total rescue analgesic consumption in 24 hours and patient satisfaction score were significantly reduced in group B than group A.

Conclusion: We conclude that 20ml of 0.2% ropivacaine in PENG block provides significantly longer duration of analgesia with decreased VAS scores on rest and dynamic hip movement thereby leading to decreased 24-hour rescue analgesic requirement and improved patient satisfaction in these patients.

Keywords: Pericapsular nerve group block (PENG), Femoral nerve (FN), Obturator nerve (ON), Accessory obturator nerve (AON)

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-5
II	AIMS AND OBJECTIVES	6
III	REVIEW OF LITERATURE	7-20
IV	MATERIALS AND METHODS	21-26
V	OBSERVATIONS AND RESULTS	27-41
VI	DISCUSSION	42-47
VII	SUMMARY AND CONCLUSIONS	48-49
VIII	BIBLIOGRAPHY	50-55

APPENDICES – I

- PROFORMA
- MASTER CHART

APPENDICES – II

- APPROVAL LETTER OF THESIS PLAN
- THESIS PLAN

LIST OF TABLES

Table No.	Title	Page No.
1.	Demographic profile: distribution of subjects according to age, gender, height, weight and BMI	29
2.	Distribution of subjects according to ASA grade	33
3.	Median duration of anaesthesia and surgery (in minutes)	34
4.	Distribution of subjects according to type of hip surgery	36
5.	Mean duration of analgesia (in hours)	37
6.	Trends in mean vas score at rest in PACU	38
7.	Trends in mean VAS score on dynamic hip movement in PACU	39
8.	Median (IQR) analgesic consumption in 24 hours post-operatively	40
9.	Quality of block as assessed by patient satisfaction score at the end of 24 hours post-operatively	41

LIST OF FIGURES

Fig. No.	Title	Page No.
1.	USG Image of PENG block showing spread of local anaesthetic between AIIS and IPE	10
2.	CONSORT Flow Diagram of the study	28
3a.	Distribution of subjects according to age	30
3b.	Distribution of subjects according to height	30
3c.	Distribution of subjects according to weight	31
3d.	Distribution of subjects according to BMI	31
3e.	Distribution of subjects according to gender	32
4.	Distribution of subjects according to ASA grade	33
5a.	Median duration of anaesthesia	34
5b.	Median duration of surgery	35
6.	Distribution of patients according to type of hip surgery	36
7.	Mean duration of analgesia (in hours)	37
8.	Trends in mean vas score at rest in PACU	38
9.	Trends in mean vas score on dynamic hip movement in PACU	39
10.	Median (IQR) analgesic consumption in 24 hours post-operatively	40
11.	Quality of block as assessed by patient satisfaction score at the end of 24 post-operatively	41

INTRODUCTION

Patients with hip fracture experience varying intensity of pain in the perioperative period necessitating the use of various parenteral or central neuraxial analgesic regimens. Ideally pain management should begin from the time of incident of fracture to facilitate examination, transportation, radiological investigations, and further management.[1] These patients are usually frail elderly besieged with multiple comorbidities, as a result of which parenteral analgesics like opioids, non-steroidal anti-inflammatory drugs (NSAIDs) and central neuraxial techniques like epidural analgesia can result in adverse effects like drowsiness, respiratory depression, renal failure, motor block etc thereby derailing early ambulation, physiotherapy and rehabilitation.[2,3] Hence peripheral nerve blocks have been developed in an attempt to enhance dynamic pain relief which promotes early recovery and improves overall outcomes for these vulnerable group of patients.

Peripheral nerve blocks (PNB) can efficiently reduce pain associated with hip fracture, have rapid-onset and site-specific analgesia that is more effective than standard systemic or central neuraxial analgesia alone. There is also moderate evidence that nerve blocks contribute to reduced rates of delirium and perhaps reduced morbidity and mortality.[4] Various benefits of PNB as a component of multimodal post-operative analgesia regimen include improvement in postoperative pain control and reduction in use of opioids,[5-10] reduction in hospital length of stay,[11,12] prevention of hospital readmissions,[13] reduction in post-operative nausea and vomiting,[5] faster movement to recovery,[14] earlier participation in physical therapy [11] and improved patient satisfaction.[5] Therefore nerve blocks for hip fractures have been strongly recommended by pain management pathway of the Health Quality Ontario [15] and by the evidence based guidelines published by the American Pain Society, the American Society of Regional Anaesthesia and Pain Medicine and the American Society of Anaesthesiologists.[16]

Multiple techniques of PNB have been employed to provide adequate analgesia with opioid sparing for patients with hip fractures and include femoral nerve block (FNB), 3-in-1 block, fascia iliaca compartment block (FICB), intra-articular injections and local anaesthetic infiltration in soft tissues surrounding surgical site (the last being suitable for postoperative pain only).[17] With the assistance of a complete understanding of relevant anatomy, these techniques can be performed safely and effectively with minimal patient discomfort and a high degree of patient satisfaction.[18] However, the obturator nerve is inconsistently covered by these blocks, while the accessory obturator nerve is not covered at all.[19]

The innervation of the hip and lower extremity is derived from the lumbosacral plexus, that is formed by the ventral rami of the lumbar and sacral spinal nerves. The three major nerves that arise from the lumbar plexus are the lateral femoral cutaneous, the femoral and the obturator nerves. These nerves which arise from the lumbar plexus mainly innervate the anterior part of the hip and thigh including the anterior part of the knee joint. Recently, the anterior capsule of the hip joint was found to have the richest nerve supply.[19] Short et al observed from their recent anatomical study that the femoral nerve (FN) and obturator nerve (ON) consistently provided innervation to the anterior hip capsule. They also found that the accessory obturator nerve (AON) is present in higher percentage of the specimens than previously suggested (54% vs. 8%-29%). High branches of the FN and AON were found to play a much greater role than that reported in the literature. These branches were found to traverse close to the periosteum between ilio- pubic eminence (IPE) and anterior inferior lilac spine (AIIS), both of which can be visualised by ultrasound. High and low ON branches provide focused innervation to the inferomedial aspect of the capsule.[20]

Using this information from the anatomical studies, Giron et al developed an ultrasound guided technique for blocking these articular

branches to hip and named it the Pericapsular nerve group block (PENG block). They placed a curvilinear, low frequency ultrasound probe in transverse plane over AIIS and then aligned it with pubic ramus by rotating probe counter clockwise. In this view, IPE, iliopsoas muscle along with its tendon, femoral artery and pectineus muscle were seen. Local anaesthetic solution was deposited in musculo- facial plane with psoas tendon anteriorly and pubic ramus posteriorly using 20G, 80mm needle from lateral to medial in an in-plane approach.[19] PENG block was performed on 5 patients using a single injection of local anaesthetic (LA) solution containing 20 ml of 0.25% bupivacaine with 1:400,000 epinephrine in 4 of 5 cases while 1:200,000 epinephrine plus 4mg dexamethasone was used along with LA in one case. Thirty minutes after the block placement, they evaluated all patients by asking them to flex at the hip. All patients were able to comply and reported significantly reduced pain scores compared with baseline. In addition, quadriceps weakness was not clinically evident in any of the patients.[19]

The peri-capsular nerve block (PENG) targets only the sensory branches of anterior capsule and has reported ability to block the FN, ON and AON at the same time thereby decreasing pain, minimizing the use of opioids, and enabling dynamic hip movements in post-operative period.[21]

In a scoping review, Morrison C et al concluded that PENG block is a promising alternative to other PNBs such as femoral nerve block (FNB) or fascia iliaca nerve block. They recommend future observational and experimental studies to determine the effectiveness, and safety of the PENG block.[22]

Three randomized control trials (RCTs) have been published in the year 2021-2022 (i.e., during the period of our study). Pascarella G et al in a randomized observer masked control trial evaluated the analgesic efficacy of PENG block versus no block on 60 patients undergoing total hip arthroplasty (THA). They observed significantly reduced pain

scores in PENG block group along with a significant decrease in opioid consumption, better range of hip motion and shorter time to ambulation. Their results suggested improved post- operative functional recovery following THA in PENG block group.[23]

Lin D et al compared the analgesic efficacy of PENG block versus FNB in hip fracture surgery in a total of 60 patients. They observed superior post- operative analgesia, better quadriceps strength in patients who received PENG block with 20 ml of 0.75% Ropivacaine. However, there were no differences observed in other outcomes notably opiate consumption and quality of recovery.[24]

Aliste J et al compared ultrasound guided PENG block with supra-inguinal FICB for THA using 20ml of 0.5% adrenalized levobupivacaine and 40ml of 0.25% adrenalized levobupivacaine respectively, with incidence of quadriceps motor block as their primary outcome. They observed statistically significant lower incidence of quadriceps motor block at 3 and 6 hours in the PENG block group as compared to supra-inguinal FICB group. Also, PENG block provided better preservation of hip adduction and decreased sensory block of the anterior, lateral, and medial thighs at all measurement intervals. However, the findings did not reveal any significant differences in terms of postoperative pain scores, cumulative opioid consumption, ability to perform physiotherapy, opioid-related side effects, and length of hospital stay. The researchers also observed residual paresis or impairment in quadriceps function and hip adduction in 25-50% of their patients receiving PENG block at 3 to 6hours, suggesting need for further evaluation of this novel block.[25]

Among the local anaesthetic agents ropivacaine has been reported to be associated with a lower incidence of motor block than bupivacaine, hence it's use should further support early mobilization in the postoperative period.[26] Nevertheless, success of blocking all nerves in musculo-facial plane PENG block depends primarily upon the optimal safe volume of local anaesthetic solutions used. The reported volume

of local anaesthetic solution used in various case series and RCTs varies between 10-20ml. There is no optimal volume reported nor any study published which compares different volumes of local anaesthetic solution in PENG block. Also, more RCTs are crucially required to validate the analgesic efficacy of PENG block in hip surgeries.

Hence we propose to conduct a randomized controlled study in patients undergoing hip surgeries under general endotracheal anaesthesia (GETA) or general anaesthesia with laryngeal mask airway (GA-LMA) so as to independently evaluate the analgesic efficacy of varying volumes of Ropivacaine 0.2% in PENG block while avoiding the confounding effects of central neuraxial techniques in the postoperative period.

AIMS & OBJECTIVES

To comparatively evaluate the analgesic efficacy of varying volumes of local anaesthetic solution on dynamic post-operative pain relief after PENG block in patient undergoing hip surgeries.

REVIEW OF LITERATURE

Implantation of prosthesis for total/partial hip arthroplasty is often accompanied with severe inflammation resulting in high intensity of pain. Immediate reduction of this pain might be an important factor in the early recovery process. Poor pain control may lead to major discomfort for the patient and also impaired early immobilization.[27] Immobilization of the patient leads to increased time spent in bed which increases the risk of deep vein thrombosis and resulting prolonged hospital stay. However standard analgesic agents like opioids and non-steroidal anti-inflammatory drugs do not seem to provide adequate analgesia. NSAIDs can cause adverse effects like nausea, gastrointestinal ulcers, renal failure.[2]

Initially recognized and conventionally simple method for post-operative (total hip arthroplasty/ hemiarthroplasty) pain management is opioid administered intravenously either as intermittent boluses or as patient controlled analgesia (PCA) infusion. However, large doses of opioids are often required which increases the risk of side effects, such as sedation, post-operative delirium, nausea, vomiting, respiratory depression.[28]

Epidural analgesia was being widely used for post-operative pain management following total /hemi hip arthroplasty. Epidural anaesthesia with an indwelling catheter prolongs pain relief, but can lead to serious and rare complications such as epidural hematoma, nerve damage, catheter displacement or epidural infection.[28] Moreover epidural administration of only local anaesthetic is associated with risk of motor blockade and difficulty in mobilization.

Recently, Cochrane systematic review compared peripheral nerve blocks to systemic analgesia for pain control after elective hip replacement surgery in adults and stated reduction in postoperative pain, increased patient satisfaction, and reduction in both postoperative

delirium and length of hospital stay in patients receiving peripheral nerve blocks.[17]

An anatomic study by Short and Baig evaluated the innervation of anterior hip capsule from which majority of pain arises. This study also identified relations of high branches of FN and ON to bony landmarks. The anterior capsule of hip joint is consistently supplied by three nerves- FN, AON, ON. Branches of both FN and ON contribute to 100% innervation whereas AON contributes to 54% innervation of the hip capsule. The articular branches from the FN to the hip joint enter the iliacus muscle at the L4–L5 level and course deep to the psoas muscle and tendon between the AIIS and IPE before innervating the hip capsule. The AON courses deep to the medial aspect of psoas muscle around the L5 level and then courses deep to the psoas around IPE to enter the anteromedial joint capsule.[20] High articular branches of FN (arising above the inguinal ligament) supplied all four quadrants of hip joint capsule. Also, obturator nerve has high branches which are branches given proximally in the obturator canal. This therefore explains modest effect of FNB and 3 in 1 block on pain in hip fractures.[5] Also FICB cannot block the articular branches from the AON and FN.[20]

An anatomical study by Birnbaum K et al [29] revealed that there exists a separation between anterior and posterior sensory innervation of the hip joint capsule. They described branches from FN innervating anterior and anterolateral region of hip capsule, ON supplying antero-medially, superior gluteal nerve innervating posterolateral anatomy, articular branches from sciatic nerve and nerve to quadratus femoris supplying posterior region of hip capsule.[29]

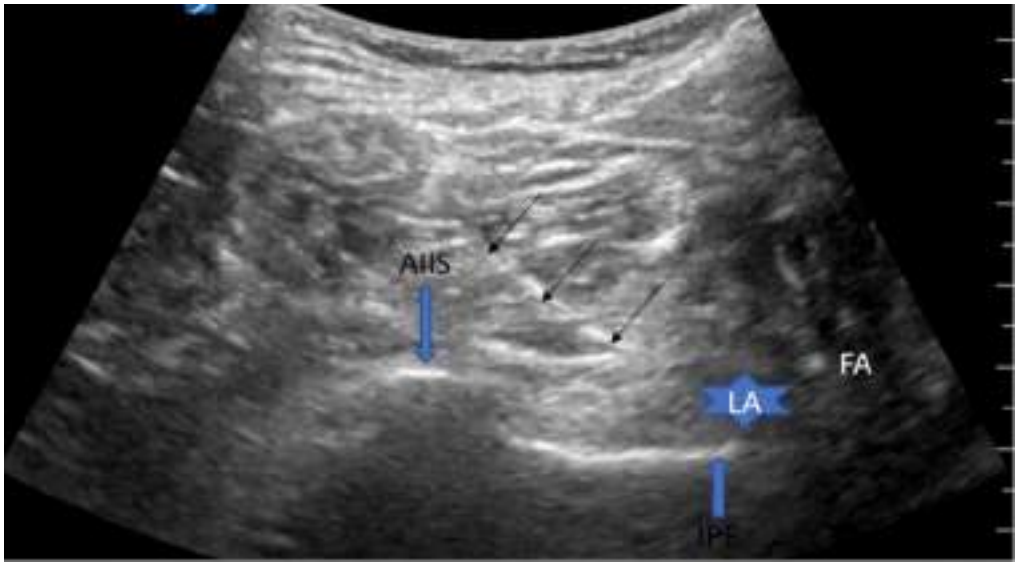
Another study by Wertheimer L et al [30] observed the nerve supply to the ventral aspect of hip joint and observed that the anterior part is almost constantly supplied by the articular branch of ON (98%). The origin of the articular branches of ON is proximal to the obturator canal (i.e. in the pelvic cavity) at the level of internal orifice.[30]

In another study by Gardner E et al [31] the nerve supply of the human hip joint was studied in dissections of adult joints and in serial sections of foetal joints. They reported that articular nerves to hip arise from the femoral, obturator and superior gluteal nerves, nerve to the quadratus femoris, AON when present and possibly from the branches of lumbar sympathetic ganglia.

In 2017 Shin J et al reviewed 14 comparative studies on post-operative pain management after arthroscopic hip surgery. Analgesic options compared were FNB, FICB, lumber plexus blocks and intraarticular injection of soft tissue surrounding surgical site injection.[28] Results revealed that patients who received FICB have less adequate pain control, higher narcotic consumption, and more overnight admissions. FICB anesthetizes femoral and lateral femoral cutaneous nerves and is thought to achieve comprehensive anaesthesia of the lateral and anterior aspect of the thigh. However, the medial, posterior, and lateral aspects of the capsule, which are innervated by nerves that originate from the sacral plexus, are not contained within the fascia iliaca compartment, and this lack of coverage may explain the inadequacy of analgesic efficacy of FICB. Unlike the Fascia illiaca block, which works by diffusion of anaesthetic agents under the iliacus fascia to anesthetize the femoral and lateral femoral cutaneous nerves (LFCN), the lumbar plexus block targets these nerves as well as the obturator and accessory femoral nerves at their origins for more complete coverage. However epidural spread remains a common complication of lumbar plexus block and can further result in motor block leading to falls and urinary retention.[28] It was therefore found out that nerve blocks although modestly effective, must be used with caution to decrease risk of falls postoperatively.

Recently, Giron et al [19] described a new technique for regional anaesthesia intended for pain control in hip fractures by using a low frequency curvilinear probe to deposit local anaesthetic in in the musculofascial plane between the psoas tendon anteriorly and the

pubic ramus posteriorly. This ultrasound- guided (USG) technique, named by the authors as the PENG (Pericapsular Nerve Group) block, includes the blockade of sensitive branches of FN and AON in a single-injection. PENG block was performed on 5 patients following a discussion of the potential risks and benefits. The authors used a single injection block of local anesthetic solution containing 20 ml of 0.25% bupivacaine with 1:400,000 epinephrine in 4 of 5 cases while 1:200,000 epinephrine plus 4mg dexamethasone in one case. Thirty minutes after the block placement, they evaluated all patients by asking them to flex at the hip. All patients were able to comply and reported significantly reduced pain scores compared with baseline. In addition, quadriceps weakness was not clinically evident in any of the patients.



AIIS: Anterior inferior iliac spine, IPE: Iliopubic eminence,
FA: Femoral artery, LA: Local Anaesthetic (0.2% ropivacaine)

Figure 1: USG Image of PENG block showing spread of local anaesthetic between AIIS and IPE

A comprehensive systematic review of literature by Morrison C et al was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines using the framework recommended by the Joanna Briggs Institute and have summarized literature published in relation to PENG block.[22] Database screening yielded 345 articles, of which 20 articles which met

the inclusion criteria were case reports and case series. In 11 studies, PENG block was described as a regional analgesia technique without other nerve blocks in a variety of settings including hip relocation, hip fracture analgesia and hip surgery.[32-41] and they reported that PENG block provides analgesia in these settings, with reduced or no need for oral or intravenous opioid analgesia. PENG block was described in combination with local anaesthetic infiltration, or other nerve blocks such as FNB, LFCN block, erector spinae block in nine studies.[42-47] PENG block has potential advantages over traditional forms of regional analgesia for hip pain, such as FNB or FICB. It provides wider and more complete coverage of sensory nerves innervating the hip, leading to more effective regional analgesia with the potential to reduce postoperative pain, increased patient satisfaction and reduced postoperative opioid consumption, potentially causing less opioid-related adverse events.[48] Furthermore, studies also confirm the absence of motor blockage after PENG block which may allow early patient mobilization and participation in rehabilitation, contributing to early recovery. Also, PENG block was used as the sole anaesthetic technique for hip relocation in two adult patients, without requiring general anaesthesia, neuraxial anaesthesia or sedation. Any serious adverse events after PENG block such as permanent nerve injury, major vascular damage or local anaesthetic systemic toxicity were not described.[22]

A retrospective study was done by Mysore K et al (July 2020) which included 123 patients out of which 47 received PENG block. PENG block was performed by injecting 20 mL of 0.25% bupivacaine with 1:200,000 epinephrine and 2 mg of dexamethasone between the psoas tendon and pubic ramus, under ultrasound guidance. Surgeons provided LIA (20–40 mL of 0.25% bupivacaine with epinephrine) for all patients. All patients received intravenous patient-controlled hydromorphone, acetaminophen (3–4 g daily), and a non- steroidal anti-inflammatory drug if co-existing medical conditions allowed. The mean 24-hr postoperative hydromorphone equivalent consumption was

lower in those receiving PENG blocks [4.5 (2.9) mg] than those who did not [6.9 (5.5) mg] (P = 0.002). Secondary outcomes (length of stay, peak pain scores, and average pain scores at rest and with activity) were not significantly different between the two groups. PENG block was associated with a 2.4 mg reduction in 24-hr hydromorphone consumption among patients receiving LIA following THA. It concluded that adding a PENG block to LIA, rather than replacing it, would gain easier acceptance from both surgeons and anaesthesiologists.[49]

Another retrospective case series published by Kukreja P et al (2020) including 12 patients who received PENG block for primary versus revision THA analgesia stated that the ultrasound-guided PENG block was successfully used in primary THA as a solo block, and it may be used in combination with other regional blocks for any hip surgery. PENG block is an easy regional technique to perform in the supine position with motor-sparing benefits.[21] PENG block was performed preoperatively with the patient in a supine position. A low-frequency curvilinear transducer was placed in the transverse plane over the anterior inferior iliac spine (AIIS) and moved over inferiorly to visualize the pubic ramus. The femoral artery and ilio pubic eminence (IPE) were then visualized. Using in-plane technique 10 cm echogenic 21 gauge needle was advanced from lateral to medial direction, and 20 ml of local anaesthetic 0.5% ropivacaine was deposited between the psoas tendon anteriorly and pubic ramus posteriorly. Two out of six patients for primary THA was done under spinal anaesthesia and rest of the four under general endotracheal tube anaesthesia (GETA), and all six out of six patients for revision THA were performed under GETA. In the primary THA group, average pain scores remained lower as compared to the revision THA group at all recorded time points during the study period. Average postoperative opioid use in the first 24 hr was 78.7 OMEs in the revision group, compared to 18.4 OMEs in the primary group. Therefore, they concluded that PENG block is an alternative regional analgesic technique for primary THA. It may be used as a potential supplement to other regional anaesthesia techniques to

effectively target articular branches to the hip joint. It can be used as an alternative to femoral nerve block or lumbar plexus block to prevent motor weakness and can be performed easily in supine position using ultrasound guidance without any discomfort of patient positioning.[21]

A study done by Sandri M et al (2020) evaluated the efficacy of the pericapsular nerve group block and local infiltration analgesia (LIA) combination as the only anaesthesia technique for the total hip arthroplasty (THA). In this preliminary case series, 10 patients (ASA I–II) underwent elective primary THA with PENG as the only anaesthesia technique and LIA, for postoperative analgesia. The anaesthetic plan, post-operative analgesia, use of opioids, length of stay (LOS), functional recovery for the hip, bleeding, complications, and adverse events were considered as outcomes. Thirty minutes before surgery, patients received midazolam (0.02 mg/kg i.v.) and fentanyl (1–2 μg/kg i.v.) to improve acceptance of anaesthesia and paracetamol (1 g), ketoprofen (100 mg), and dexamethasone (4 mg) as part of the multimodal approach for postoperative analgesia. THA was performed on patients in the supine position. The surgeon infiltrated the skin and the subcutaneous tissue with 10 ml of mepivacaine 1%. The PENG block was performed by a single injection of a 40 ml solution containing 100 mg of 0.25% isobaric levobupivacaine and dexamethasone (4 mg) under ultrasound guidance with a 20-gauge needle, 100 mm in length (Stimuplex Ultra 360®; B-Braun). The articular branches from femoral and accessory obturator nerves were intercepted between the anterior inferior iliac spine and the ilio-pubic eminence, whereas the obturator nerve was possibly reached by the local anaesthetic spread between the pectineus and obturator externus muscles. For LIA, 80-ml mixture of levobupivacaine (100 mg), ketorolac (30 mg), epinephrine (0.1 mg), and morphine (10 mg) was injected. A 10-cm 19-G spinal needle was used to inject drugs into periarticular tissues. To verify the effectiveness of PENG block as the only anaesthesiologic technique, LIA was performed on the first 5 patients during surgery with the “moving needle” technique one layer at a time as the operation

progressed, on the other 5 patients LIA was injected at the end of surgery before running sutures for the tensor fascia lata. An intravenous propofol infusion rate of 0.025–0.050 mg/kg/min kept patients lightly or moderately sedated during surgical procedures. Postoperative pain control was managed with 1000 mg of paracetamol and 100 mg of keto-profene i.v. 6 h after surgery and continuing three times a day for 24 h (day 0). On day 0, if patients had a NRS score ≥ 4, morphine (1 mg) was intravenously administered until the score was < 4, and keto-profene (100 mg) as a rescue medication from day 1. Safety and efficacy were assessed, including the subjective patient satisfaction, optimal pain relief, no conflict with surgical perspectives, and local anaesthetic systemic toxicity. They also evaluated the duration of surgery and patient mobility upon leaving the operating room. All patients were fully satisfied and improvement in pain relief, symptoms, and functional activity was remarkable. Intraoperative blood losses ranged 100–600 ml. No intraoperative complications or signs of toxicity occurred. The median duration of surgery was 59.5 ± 4.5 min and the hospital stay ranged between 2 and 3 days. blood losses and adverse events. Thereby, they documented that PENG block and LIA could be hypothesized as an effective and safety anesthesia technique for the THA surgery, facilitating hip functional recovery and limit intraoperative blood losses and adverse events.[42]

Jadon A et al (2020) compared USG guided vs landmark based technique for PENG block in a total of 10 patients (4 males and 6 females) with fracture hip scheduled for hip surgery under spinal anaesthesia. In 4 patients ultrasound guided PENG block using out-of-plane approach and in 6 patients landmark based nerve stimulator guided block was administered with 20ml 0.25% bupivacaine and 8mg dexamethasone. Pain relief before and after 30 minutes of block was assessed by numeric rating scale (NRS) and comfort during spinal position was assessed by ease of spinal position score (EOSP). All 10 patients had successful block; NRS at rest was 6 (6-9) Vs 2 (0-2) and on 15 °limb elevation was 8 (8-10) Vs 3 (2-4). All patients could sit

comfortably during spinal anaesthesia and median (range) EOSP sore was 3 (2-3). No complication was observed. Therefore it concluded that landmark based technique for PENG block is a feasible option and can be used safely where ultrasound facility is not available.[50]

Buono R e al (2020) published a case series of 8 patients who received PENG block for hip joint pain along with continuous infusion via catheter. PENG block was administered with an introducer needle. The catheter was then inserted 3 cm beyond the needle tip. In three patients, blood aspiration through the catheter occurred. In each patient, the catheter was repositioned 0.5–1.0 cm more medially. No blood aspiration or visible hematoma occurred subsequently. The presence of any vascular structure deep to the iliopsoas muscle was excluded postoperatively based on a Doppler color flow scan. All 10 patients reported good pain relief. The median (IQR) Numerical Rating Scale (NRS) score decreased from 7 (6–7) before the block to 2 (2–2.75) 20 min after PENG catheter placement. The median (IQR) NRS score after 12, 24 and 48 hours were 2 (2–3), 2 (2–3), and 2 (0.25–2), respectively. Patients underwent surgery 24–48 hours following catheter placement. Catheters were removed by an Acute Pain Service nurse 72 hours post insertion. Therefore they concluded that PENG block is a promising technique. However randomized controlled trials of high methodological quality are required to further elaborate the role of this block.[51]

Beriloz B et al (March 2021) discussed PENG block as a part of continuing education activity. This article mainly described the technique of nerve block, identified the indications for the PENG block and summarized the risks associated with this nerve block. Contraindications for placement of block were lack of patient consent, skin infection at the site of injection, systemic bacteremia or sepsis and patients on anticoagulation and antithrombotic medications. Block was performed with patient in supine position. The procedural leg was slightly abducted. Mild to moderate sedation was administered (50 -100

mcg of fentanyl and 1-2 mg midazolam intravenously).Utilizing the aseptic technique, the ultrasound probe was placed on a transverse plane over the ASIS. Once the ASIS is identified, the transducer was aligned with the pubic ramus and rotated at approximately 45 degrees, parallel to the inguinal crease. The transducer was then slid medially along this axis until the AIIS, IPE and the psoas tendon is clearly identified, serving as anatomic landmarks. A standard 20-22 gauge 100mm needle was inserted in-plane, from lateral to medial, in the plane between the psoas tendon and the pubic ramus. 15-20ml of a long-lasting local anesthetic ((i.e., 0.5% ropivacaine) was then deposited in this plane, lifting the psoas tendon. General complications resulting from peripheral nerve blockade included infection, bleeding, neuropathy, and systemic toxicity from large volume local anaesthetic deposition. Therefore, the authors elicited that proximal approach of PENG confers several advantages over femoral nerve block by providing more complete analgesia to hip joint. Additionally the motor function of the involved extremity can be spared. Thus PENG block can be used alone as a primary analgesic or in conjugation with other forms of anaesthesia during surgery or in the perioperative period. For lateral incisions, a supplemental LFCN block provides additional coverage.[52]

An observational cohort study was done by Allard C et al (2021) on comparison between femoral block and PENG block in femoral neck fractures. Total of 42 patients were included out of which 21 patients received either FNB or PENG block. Thirteen total hip arthroplasties (THA) and eight hemi arthroplasties (HA) were included in each group. Using a curvilinear low-frequency ultrasound probe (5 MHz) placed in a transverse plane over the Anterior Inferior Iliac Spine (AIIS) and rotated to be aligned with the pubic ramus, a 80 mm needle was inserted to inject 20ml of ropivacaine 3.5 mg/ml. The primary outcome was the comparison of cumulative postoperative morphine consumption 48 hours after surgery. The median, postoperative, morphine equivalent consumption at 48 hours was 10 [0-20] mg and 20 [0-50] mg in Femoral and PENG groups respectively (p = 0.458). No statistically

significant differences were found in postoperative pain intensity, time to ambulation, incidence of morphine-related side effects, or length of hospital stay. The postoperative muscle strength of the quadriceps was greater in the PENG group than in the Femoral group (5/5 vs. 2/5, p = 0.001). Therefore they documented that PENG block was comparable to FNB for postoperative pain control but produced less quadriceps muscle block. Also the analgesia area covered by the PENG block was theoretically larger than the one covered by the FNB, by blocking other nerves involved in hip innervation such as the joint branches of the obturator and accessory obturator nerves, postoperative morphine consumption was not statistically different between the two groups. Hence the authors came to a conclusion that PENG block may provide equivalent postoperative morphine consumption, compared to femoral block in patients operated on for femoral neck fractures. However, postoperative quadricipital mobility is significantly preserved with PENG block, which could be exploited by an earlier lifting in the context of ERAS. However more studies with a prospective multicentric design and with a greater number of patients should be done to confirm this result.[53]

In a case series by Ueshima H and Otake H, the combination of pericapsular nerve block and popliteal block was reported as an effective analgesic for below knee amputations.[54] The same group of authors also reported efficacy of PENG block as an analgesic for hip surgeries and dislocation of hip joint[55,56]. While the authors used 20ml of 0.25% levobupivacaine for below knee amputation and hip surgeries[54], they reduced the volume of local anesthetic solution to 10 ml of 1% lidocaine for reduction of dislocated hip[56] and observed similar analgesic effect in all these case scenarios.

Pascarella G et al performed PENG block in patients undergoing total hip arthroplasty (THA). Primary outcome measured in first 48 hours after surgery was maximum pain scores ranging from 0-10 on numeric rating scale (NRS) while post-operative opioid consumption, patient

mobilization, length of stay in hospital were considered as secondary outcomes. A total of 60 patients were included out of which 30 were either given PENG block or no block after spinal anaesthesia. Multimodal analgesia in the form of acetaminophen, ketorolac, and dexamethasone were given intravenously before surgery. Wound infiltration with 20 ml ropivacaine 0.375% was performed by surgeon towards the end of procedure as PENG block omits analgesia for skin incision and does not eliminate superficial pain. Block was performed with a curvilinear probe, thereby injecting 20 ml of ropivacaine 0.375% in the plane beneath the iliopsoas muscle. Post- operative analgesia administered was ketorolac 60mg iv every 24 hours, acetaminophen I gm iv three times a day and 15mcg of sufentanil tablets via patient controlled analgesia (PCA) pump. The maximum NRS pain scores of patients receiving PENG block was significantly lower than the control group at all time period. Sufentanyl was required in all patients and 20 patients in control and PENG group respectively. Also range of motion was significantly better in the PENG group. Every patient in the control group used sufentanil tablets, while 10 patients (33%) in the PENG group did not take any. Total opioid consumption was median (IQR [range]) 2 (0–2 [0–9]) sufentanil tablet administration in the PENG group vs. 5 (3–6 [2–9]) of the control group ($p < 0.001$, Fig. 4), which is equivalent to 4.0 (4.5) vs. 8.9 (4.0) morphine mg. Mean time to first opioid in the PENG group was 6 h later than the control group. Hence they concluded that PENG block is an effective opioid sparing analgesic technique leading to early postoperative mobilisation and can be considered as a valid analgesia option for hip surgeries.[23]

Aliste J et al conducted a randomized control trial comparing PENG block and supra-inguinal FICB for THA. Incidence of quadriceps motor block was considered as primary outcome. Total of 40 patients receiving spinal anaesthesia were randomly allocated to receive either PENG or suprainguinal FICB using 20 mL of 0.5% levobupivacaine and 40 mL of 0.25% levobupivacaine respectively. Pain scores at 3, 6, 12, 18, 24, 36, and 48 hours, breakthrough morphine consumption at 24

and 48 hours, opioid-related side effects, ability to perform physiotherapy at 24 and 48 hours and length of stay were observed during the performance of block. Along with it, sensory and motor assessment was performed at 3, 6, and 24 hours. Thereby they concluded that compared to supra- inguinal FICB, PENG resulted in significantly lower incidence of quadriceps motor block at 3 and 6 hours with better preservation of hip adduction at 3 hours and decreased sensory block of the anterior, lateral, and medial thighs at all measurement intervals. However, no clinically significant differences in terms of postoperative pain scores, cumulative opioid consumption at 24 and 48 hours, ability to perform physiotherapy, opioid-related side effects, and length of hospital stay were observed. Therefore they summarized that PENG results in better motor sparing than supra-inguinal FICB. But additional investigations are required to elucidate optimal volume of local anaesthetic.[25]

Another double-blinded randomized control trial comparing the analgesic efficacy of PENG block with FNB in hip fracture surgery was performed by Lin D et al in a total of 60 patients. Block was placed 15–45 min preoperatively by ultrasound guidance using 20 mL of 0.75% ropivacaine. Surgical technique and type of anaesthesia were performed according to the treating physicians, using a local protocol that allowed for variation within a small range. NRS ranging from 0 to 10 was considered as primary outcome whereas postoperative quadriceps strength, opiate use, complications, length of hospital stay, and patient-reported outcomes were taken as secondary outcomes. On day 0, pain scores were significantly lower in PENG group as compared to FNB group. Also, quadriceps strength was better preserved in the PENG group. However there were no differences detected in the quality of recovery amongst both groups. Hence, they concluded that PENG block should be considered to reduce perioperative pain. for hip arthroplasties.[24]

Multiple other case reports as well as case series also report use of PENG block either in isolation or in combination with other blocks.[33,38,48]

Taken together, these studies suggest that, PENG is an effective post-operative analgesia for hip surgeries as it has reported ability to block the femoral, obturator and accessory obturator nerve at the same time thereby decreasing pain, enhancing post- operative mobilization due to minimal motor block and minimizing the use of opioids in post-operative period leading to improved outcomes. Hence, we propose to evaluate the post-operative analgesic duration and efficacy of US guided PENG block when administered using varying volumes of 0.2% ropivacaine, in patients undergoing hip surgeries under General anaesthesia with tracheal intubation (GETA) or General anaesthesia with Laryngeal Mask Airway (GA-LMA).

MATERIALS AND METHODS

SOURCE OF DATA

A randomized double blinded observational study has been conducted in the department of Anaesthesiology, Dayanand Medical College &Hospital, Ludhiana after approval by Institutional Ethics Committee on a total of 70 adult patients undergoing hip hemiarthroplasty, total hip arthroplasty or dynamic hip screw fixation under general anaesthesia with tracheal intubation (GETA) or General anaesthesia with Laryngeal Mask Airway (GA-LMA) who were randomly allocated to either of the 2 study groups of 35 patients each by computed generated randomization codes contained in sealed, sequentially numbered envelopes. A written informed consent was obtained from each patient

METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA:

- Patients scheduled for hip surgeries i.e. hip hemiarthroplasty, total hip arthroplasty, Dynamic hip screws (DHS) under GETA or general anaesthesia with Laryngeal Mask Airway (LMA)
- ASA I, II& III patients
- Cognitive ability to comprehend VAS scale

EXCLUSION CRITERIA:

- Frank coagulopathy evidenced by history and laboratory investigations
- Infection at injection site
- Allergy to local anaesthetic drugs
- Patients receiving spinal/CSE block for hip surgeries
- ASA IV patients
- Patients on chronic opioid abuse
- Diabetic neuropathy
- Use of opioids for chronic analgesia

GROUP ALLOCATION:

Seventy patients were recruited for the study to account for dropouts and an equal number of patients were allocated randomly using computer generated random number list to either of the 2 groups:

GROUP A:

Comprising of 35 patients who received local anaesthetic solution of 10 ml of 0.2% Ropivacaine constituted in a 20 ml syringe.

GROUP B:

Comprising of 35 patients each who received local anaesthetic solution of 20ml of 0.2% Ropivacaine in a 20ml syringe.

All syringes were labelled as study drug and wrapped with sterile adhesive tape after drawing the local anaesthetic solution as per group allocation, to maintain blinding.

The randomization scheme using computer generated random number was prepared by our biostatistician and those involved in the study were unaware of the group allocation. The allocation envelope was opened by an anaesthesiologist who was not involved with the direct clinical care of the patient. This anaesthesiologist prepared the local anaesthetic solution as per random allocation sequence and handed the sterile study drug syringes to the senior anaesthesiologist performing the PENG block. A blinded observer assessd the preoperative and postoperative pain scores. This observer was not involved in the direct clinical care of the patient. These codes were decoded at the end of study period.

PRE ANAESTHETIC CHECKUP

Routine thorough checkup was conducted comprising of detailed history, comorbidities, allergy to any drug being used, general physical and systemic examination. Patients were explained about the study being conducted and written informed consent was taken and also educated on the use of VAS scale. Relevant investigations were sent and reviewed.

Preoperative VAS at rest and on dynamic movement was noted prior to shifting the patient into the operating room (OR) in the preoperative

holding area. Demographic information including BMI, age and sex, type of hip surgeries were recorded.

ANAESTHESIA TECHNIQUE

On arrival in the OR, patients were positioned on the operating table in the supine position and routine monitoring in the form of 5-lead electrocardiography, non-invasive blood pressure (NIBP), temperature and pulse oximeter and end tidal CO_2 ($EtCO_2$) were instituted. Heart rate (HR) was recorded using 5 lead electrocardiography and non-invasive non-invasive blood pressure (NIBP) using an automated non-invasive device that was cycled every 1 min until three consecutive measurements of systolic blood pressure (SBP) were recorded and mean of three readings was recorded as baseline. General anaesthesia with tracheal intubation (GETA) of general anaesthesia with laryngeal mask airway (GA-LMA) was administered using a standard uniform induction and maintenance technique. Injection Fentanyl 1-2 mcg/kg, and injection dexamethasone 8mg i/v was administered at the time of anaesthesia induction in all patients.

PENG block was performed under USG guidance after anaesthesia induction and securing of airway had been accomplished. A curvilinear low frequency (2-5 MHz) ultrasound probe was initially placed in a transverse plane over the Antero inferior iliac spine (AIIS) and then aligned with the pubic ramus by rotating the probe counter clockwise approximately 45 degrees. In this view, the Illiopubic eminence, the iliopsoas muscle and tendon, the femoral artery, and pectineus muscle was visualised. A 21-gauge, 100 cm stimuplex ultra 360 (B BRAUN) needle was inserted from lateral to medial direction in an in-plane approach, to place the tip of the needle in the musculofascial plane between the psoas tendon anteriorly and the pubic ramus posteriorly. Following negative aspiration, the study drug was injected slowly while observing for adequate fluid spread in this plane. Both the patient and the observer were blinded to the nature of study drug being used.

Intraoperative supplemental fentanyl was administered at the discretion of the attending anaesthesiologist and recorded.

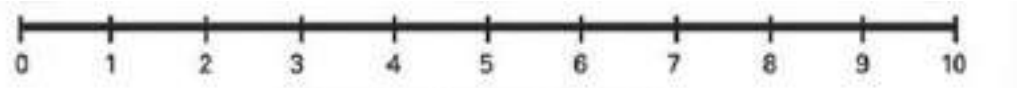
Surgery was initiated after institution of the PENG block and standard uniform technique for extubation was also followed in all patients at the end of the surgery. Additional parenteral IV analgesics were not administered towards the end of the procedure.

FOLLOWING OUTCOMES WERE OBSERVED POSTOPERATIVELY:

Primary outcome was to evaluate the analgesic efficacy of varying volumes of local anaesthetic solution on dynamic pain after PENG block in postoperative period. This was evaluated using the following:

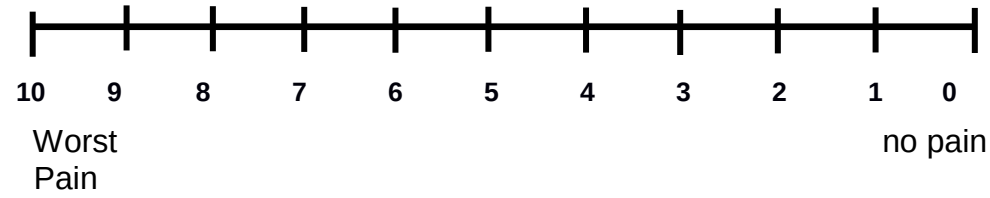
- Duration of analgesia- Duration of analgesia was defined as the time from shifting the patient to post anaesthesia care unit (PACU) to the time of first requirement of rescue analgesic at VAS ≥4.
- Visual analogue scale (VAS) was recorded preoperatively i.e prior to block administration in the preoperative holding area and then postoperatively every hourly for the first 4 hours and then 2 hourly for next 2 hours and then 4 hourly till 24 hours. VAS was observed at rest and on dynamic movement at each point in time. Dynamic hip movement was achieved by asking the patients to flex at the hip and perform a straight leg raise of the affected limb to 15 degrees.[19]

The score was determined by asking the patient to rate the pain from 0-10, where in 0 being the least pain and 10 being the maximum.



No pain

worst pain



SECONDARY OUTCOMES:

- Comparative consumption of total amount of rescue analgesic in 24 hour post-operative period among both groups.

Injection tramadol 50-100mg i/v was used as rescue analgesic whenever the VAS ≥ 4, to a maximum of 400mg within 24 hours [57] following which if still VAS>4 then another rescue analgesic, injection Fentanyl 1mcg/kg i/v was adminstered as a slow bolus shall be administered.

- Patient satisfaction score was measured by asking the patient to rate their satisfaction on a 5-point Likert scale 24 hours after surgery in post anaesthesia care unit (PACU) prior to shifting them to their respective ward.

STATISTICAL ANALYSIS

Data was described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test was performed and Fischer exact test was used when the expected frequency was less than 5. A probability value (p value)less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS (Statistical Package for

the Social Science) SPSS 21 version statistical program for Microsoft Windows.

SAMPLE SIZE CALCULATION

It was assumed that the prevalence rate of hip surgeries in our hospital was 4.2% based on previous data.

Are there were no studies comparing pain reduction

Assumptions:

Confidence Level = 95%

Precision (d) = ± 5%

For estimation of sample size, the following formula has been used

$n = (Z^2\alpha \text{ X } P \text{ X } (1\text{-}P))/d^2$

Where;

Zα = Value of standard normal variate corresponding to α level of significance

P = Likely value of parameter

Q = 1 – P

d = Margin of errors which is a measure of precision

With these assumptions a sample size of 62 patients would be included in the study. In addition, accounting for a 10% drop out rate we propose a sample size of 70 patients for our study.

We also conducted a post-hoc power analysis using G* power version 3.1.9.2 (Franzfaul, University- Kiel, Germany) software. The alpha level used for this analysis was $p < 0.05$ and beta was 0.20. Hence using the results of the primary objective of our study (Mean duration of Analgesia) power of 1.000 was calculated.

OBSERVATION & RESULTS

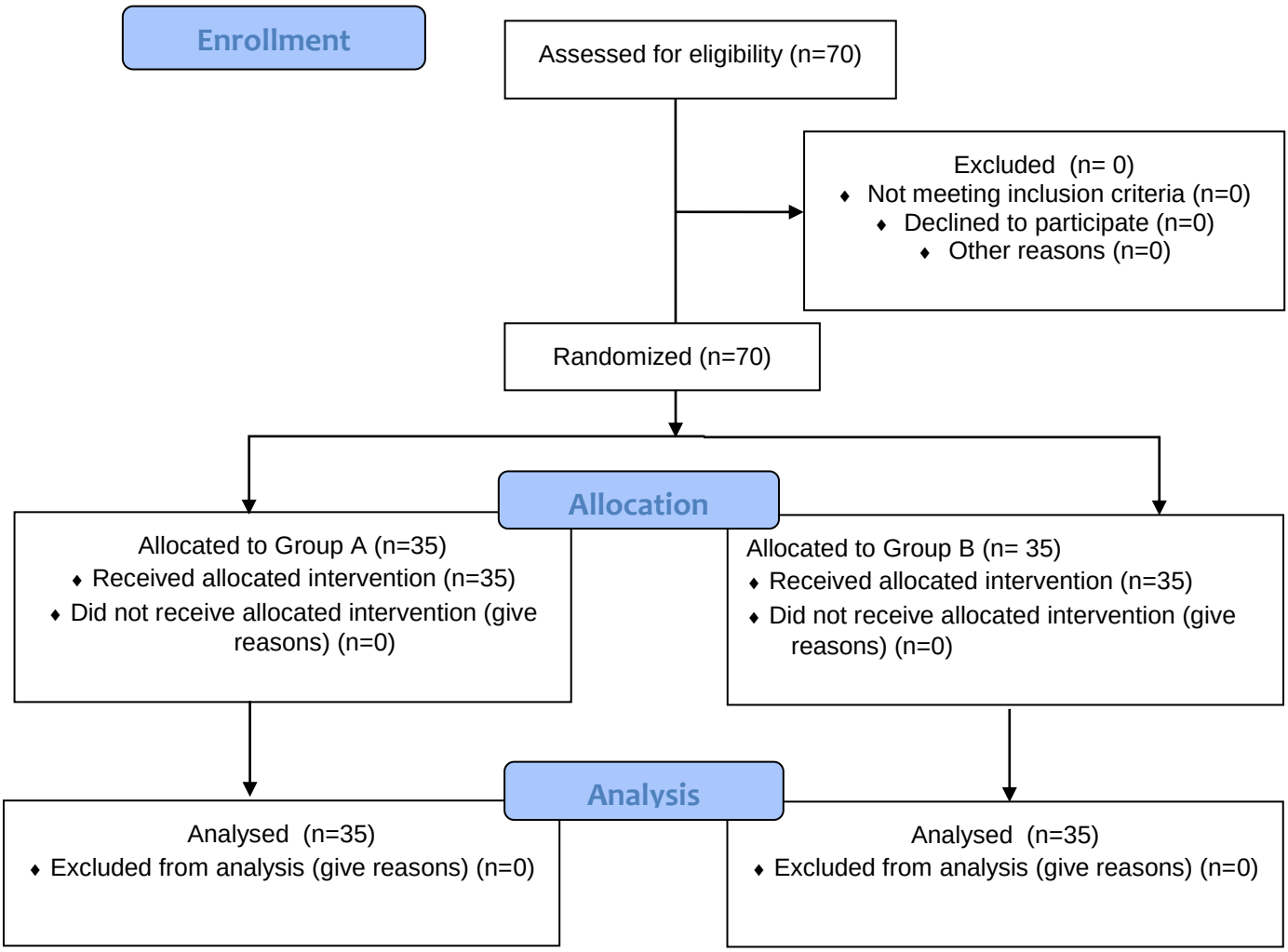
The present randomized control study was conducted in a prospective manner in the department of Anesthesiology, DMCH Ludhiana on a total of 70 patients scheduled for hip hemiarthroplasty, total hip arthroplasty, Dynamic hip screws (DHS) under GETA or GA-LMA belonging to ASA grade I, II& III.

The study aimed to evaluate the analgesic efficacy of varying volumes of local anaesthetic solution for post- operative pain relief in patients undergoing hip surgeries.

On arrival to post anesthesia care unit (PACU), the following outcomes were noted:

- Duration of analgesia.
- Assessment of pain using VAS scores at 1 hour, 2 hours, 3 hours, 4 hours, 6 hours, 8 hours, 12 hours, 16 hours, 20 hours and 24 hours.
- Consumption of total amount of rescue analgesic in 24 hour period among both groups.
- Patient satisfaction score.

Figure 2: CONSORT Flow Diagram of the study


Enrollment
Assessed for eligibility (n=70)
Excluded (n= 0)
♦ Not meeting inclusion criteria (n=0)
♦ Declined to participate (n=0)
♦ Other reasons (n=0)
Randomized (n=70)
Allocation
Allocated to Group A (n=35)
♦ Received allocated intervention (n=35)
♦ Did not receive allocated intervention (give reasons) (n=0)
Allocated to Group B (n= 35)
♦ Received allocated intervention (n=35)
♦ Did not receive allocated intervention (give reasons) (n=0)
Analysis
Analysed (n=35)
♦ Excluded from analysis (give reasons) (n=0)
Analysed (n=35)
♦ Excluded from analysis (give reasons) (n=0)

A total of 70 patients were enrolled for the study and all of them completed the study. They were divided in 2 groups of 35 patients each and were randomly allocated to either of the groups by computer generated random numbers. All of them received the interventions and there were no dropouts. They were analyzed using SPSS 21 version statistical program for Microsoft Windows.

TABLE 1: DEMOGRAPHIC PROFILE: DISTRIBUTION OF SUBJECTS ACCORDING TO AGE, GENDER, HEIGHT, WEIGHT AND BMI

	Group A		Group B		t	p-value
	Mean	SD	Mean	SD		
Age	49.43	14.93	55.89	17.00	-1.688	0.096
Height	166.97	8.11	164.97	7.47	1.073	0.287
Weight(kg)	68.20	11.32	66.09	10.44	0.812	0.419
BMI	24.34	3.62	24.20	3.18	0.168	0.867

		GROUP A		**GROUP B**		Total	Chi-square value	p-value
		GROUP A	**GROUP A**	**GROUP B**	**GROUP B**			
Gender	F	13	37%	14	40%	27	0.06	0.806
	M	22	63%	21	60%	43		
Total		35	100%	35	100%	70		

Both the groups were statistically comparable in respect to the demographic data.

Mean age in Group A was 49.43±14.93 years and in group B it was 55.89± 17.00 years. Mean height in Group A was 166.97±8.11 cm and in group B it was 164.97±7.47cm and the mean weight was 68.20±11.32kg and 66.09±10.44 in group A and B respectively. Mean BMI being 24.34±3.62kg/m2 and 24.20±3.18kg/m2 in group A and B respectively.

In group A 63% of the patients were males and in group B 60% were males. The distribution of subjects across both groups were comparable.

FIGURE 3a: DISTRIBUTION OF SUBJECTS ACCORDING TO AGE

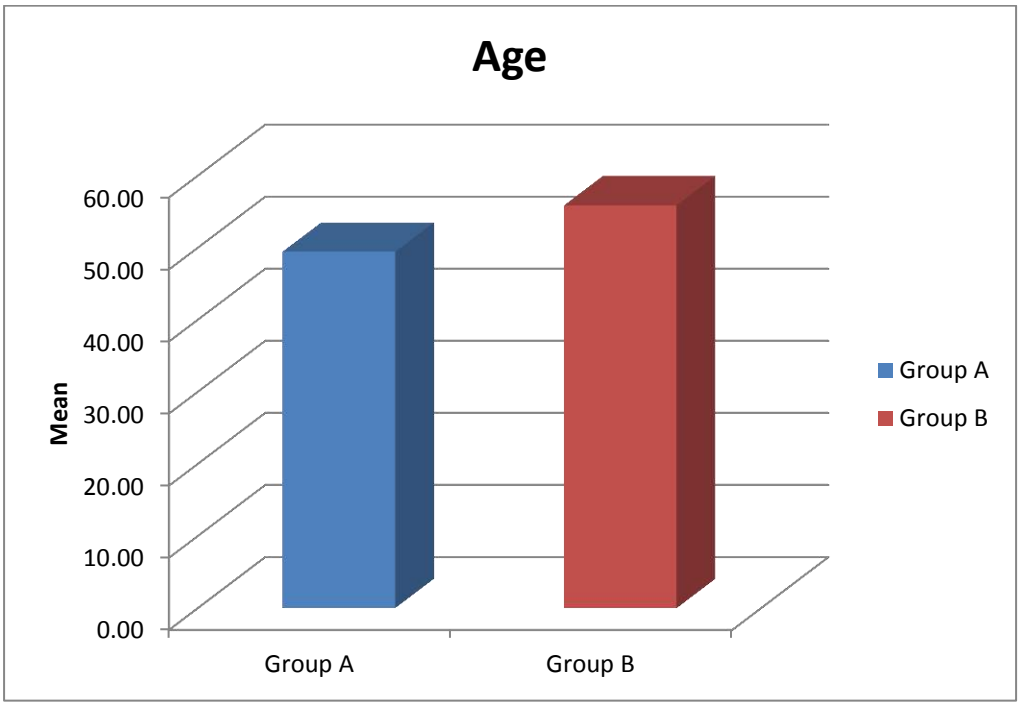


FIGURE 3b: DISTRIBUTION OF SUBJECTS ACCORDING TO HEIGHT

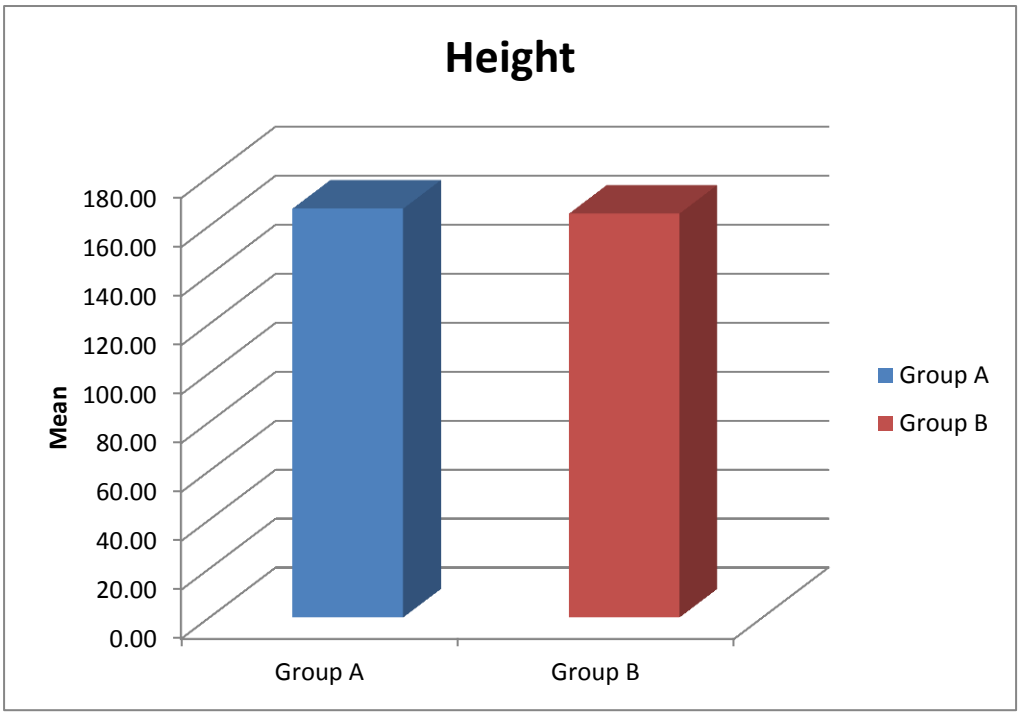


FIGURE 3c: DISTRIBUTION OF SUBJECTS ACCORDING TO WEIGHT

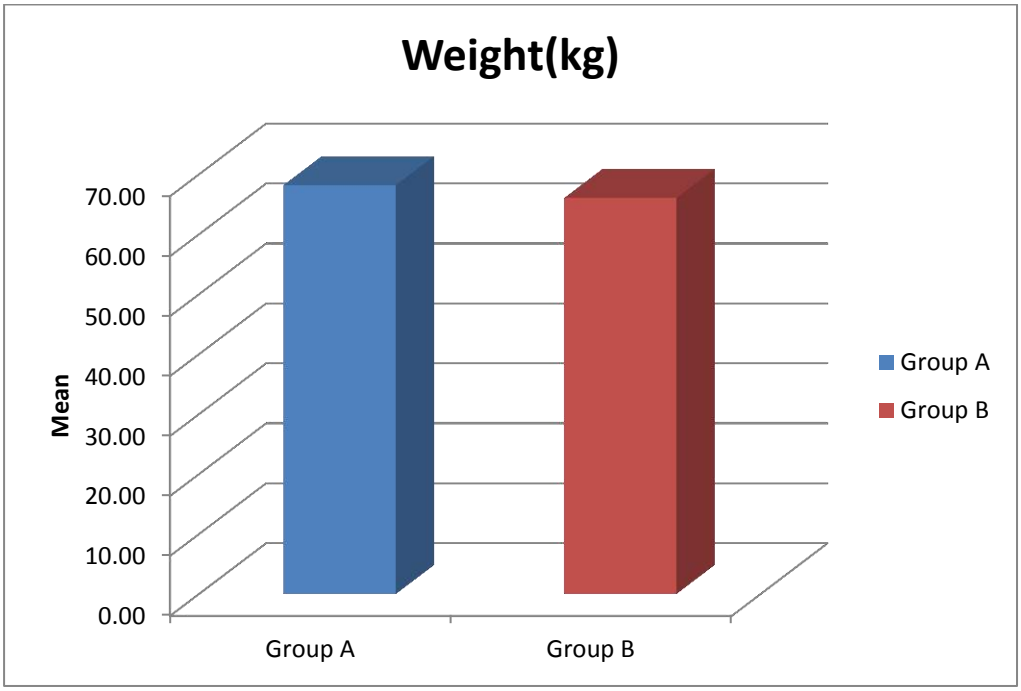


FIGURE 3d: DISTRIBUTION OF SUBJECTS ACCORDING TO BMI

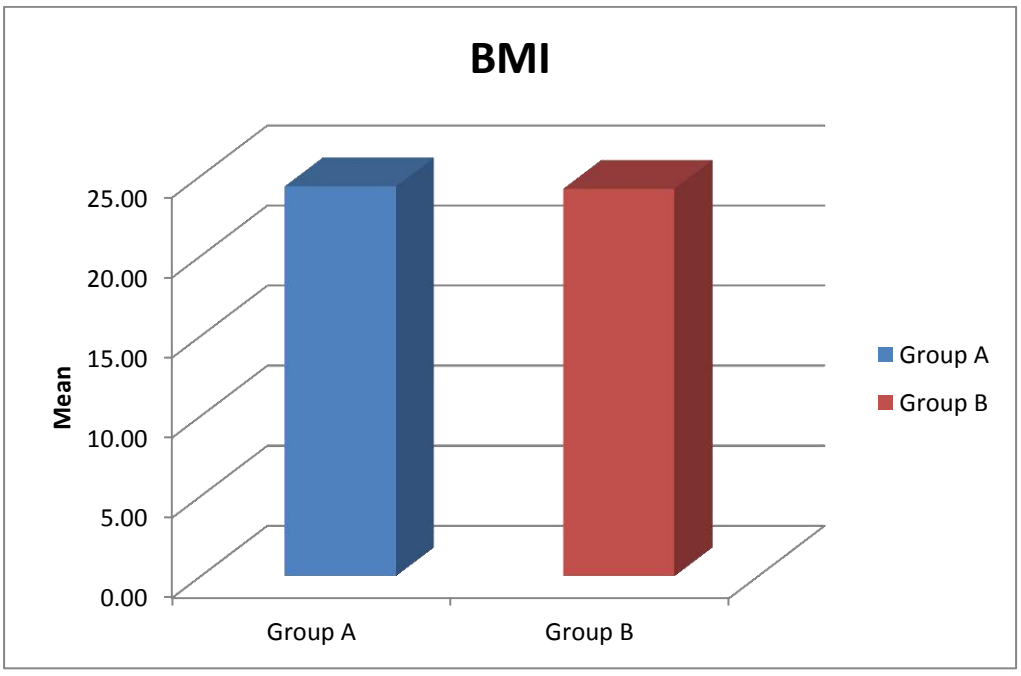


FIGURE 3e: DISTRIBUTION OF SUBJECTS ACCORDING TO GENDER

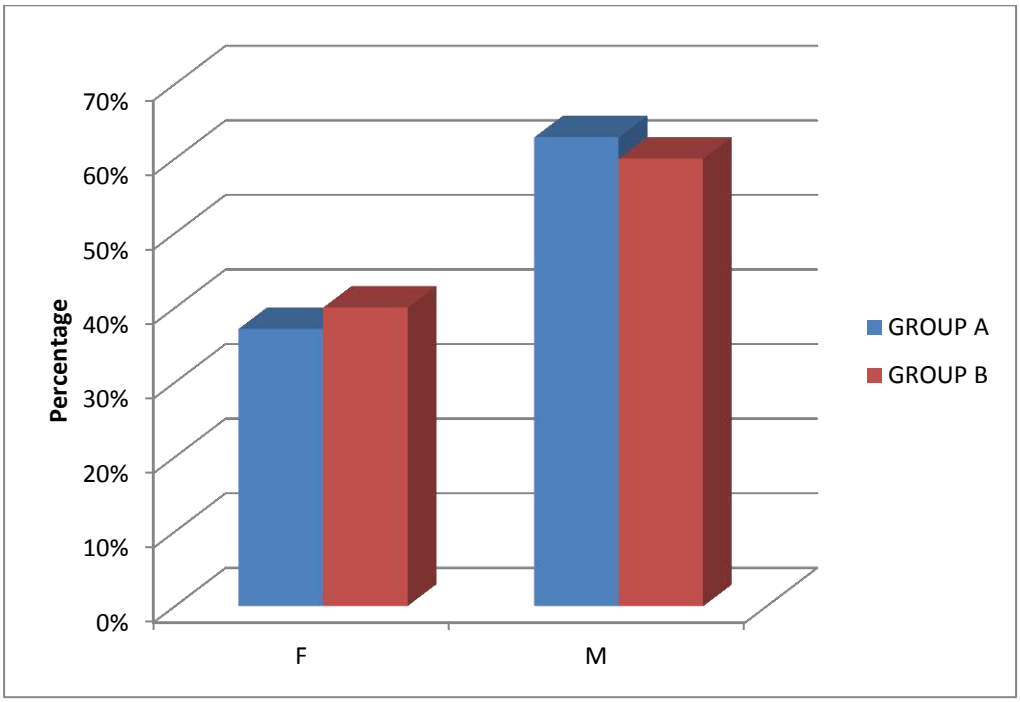


TABLE 2: DISTRIBUTION OF SUBJECTS ACCORDING TO ASA GRADE

		GROUP A		GROUP B		Total	Chi-square value	p-value
		GROUP A	GROUP A	GROUP B	GROUP B			
ASA grade	1	9	26%	8	23%	17	0.236	0.889
	2	19	54%	21	60%	40		
	3	7	20%	6	17%	13		
Total		35	100%	35	100%	70		

In group A, 26% patients belonged to ASA I, 54% belonged to ASA II, and 20% belonged to ASA III. In group B, 23% patients belonged to ASA I, 60% belonged to ASA II, and 17% belonged to ASA III. Both the groups were statistically comparable.

FIGURE 4: DISTRIBUTION OF SUBJECTS ACCORDING TO ASA GRADE

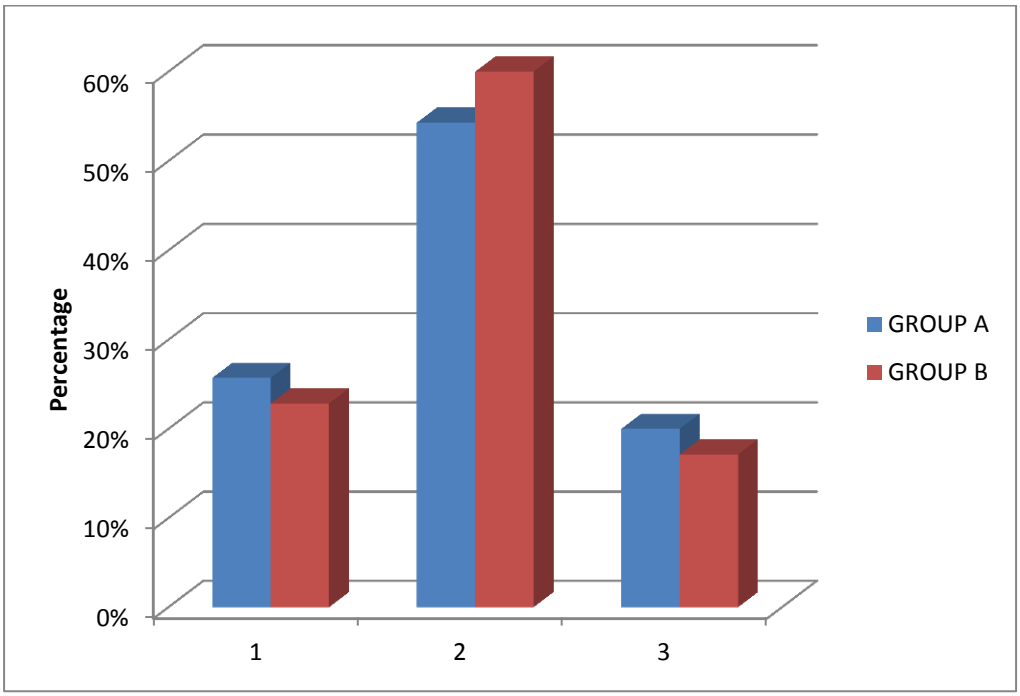


TABLE 3: MEDIAN DURATION OF ANAESTHESIA AND SURGERY (in minutes)

	Group A		Group B		Z	p-value
	Median	IQR	Median	IQR		
Duration of Anaesthesia in minutes (time from anaesthesia induction to uneventful extubation)	150	120-180	150	120-180	-0.030	0.976
Duration of surgery in minutes (time from skin incision to closure)	135	105-165	120	105-165	-0.142	0.887

The median duration of anaesthesia and surgery was comparable in both groups.

FIGURE 5a: MEDIAN DURATION OF ANAESTHESIA

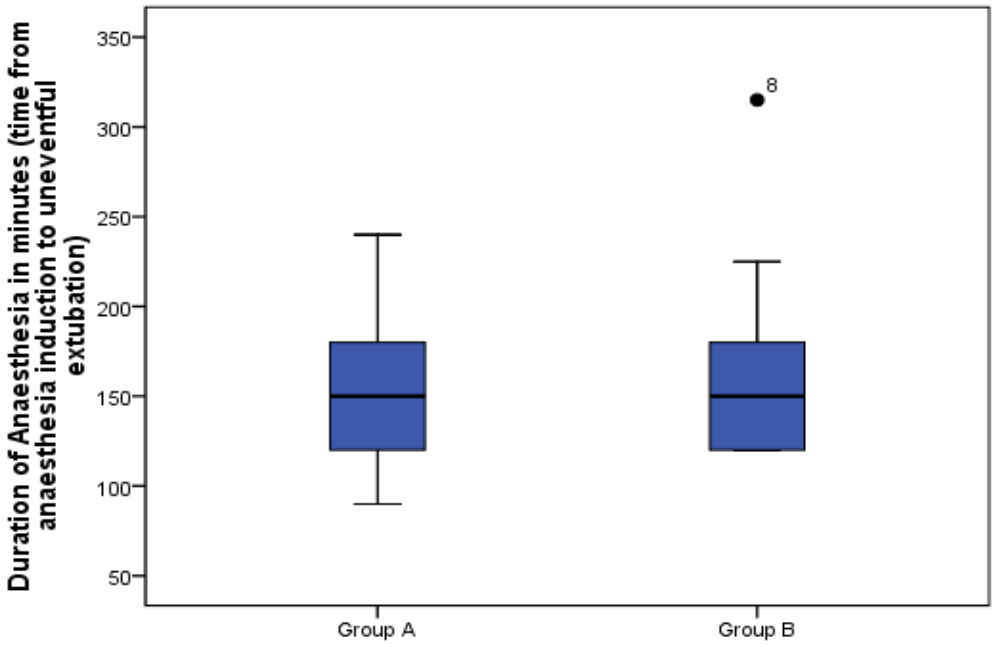


FIGURE 5b: MEDIAN DURATION OF SURGERY

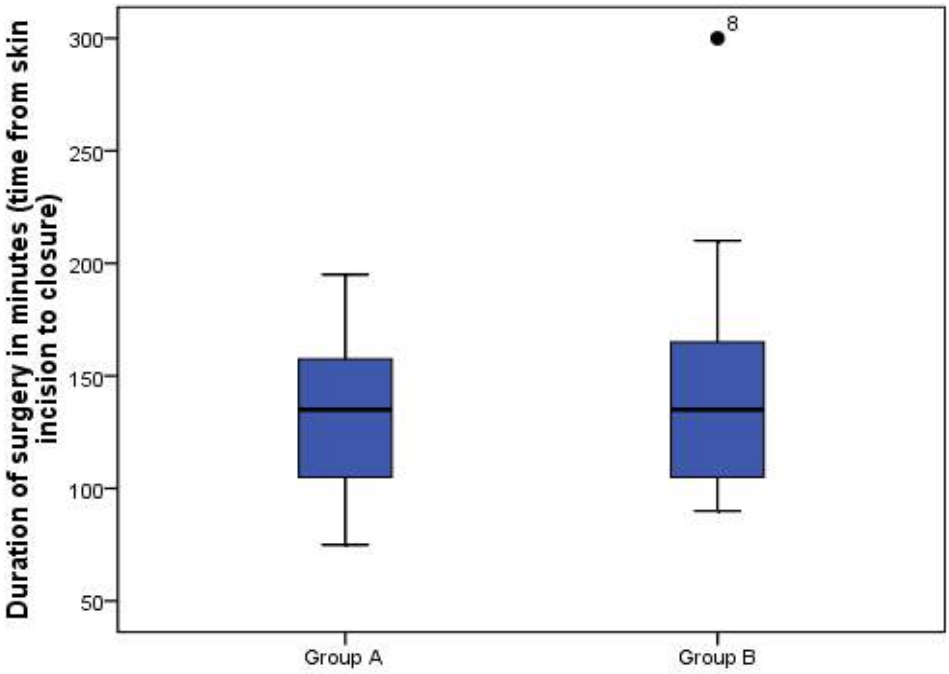


TABLE 4: DISTRIBUTION OF SUBJECTS ACCORDING TO TYPE OF HIP SURGERY

		GROUP A		GROUP B		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
TYPE OF HIP SURGERY	**DYNAMIC HIP SCREW FIXATION**	1	3%	3	9%	4	1.253	0.535
	HEMIARTHROPLASTY	11	31%	12	34%	23		
	TOTAL HIP REPLACEMENT	23	66%	20	57%	43		
Total		35	100%	35	100%	70		

In group A, 66%, 31% and 3% of subjects underwent total hip arthroplasty., hemiarthroplasty and dynamic hip screw fixation respectively. In group B, total hip arthroplasty, hemiarthroplasty and dynamic hip screw fixation was performed in 57%, 34% and 9% of subjects respectively. This overall distribution of subjects in regard to type of surgery was comparable in both groups.

FIGURE 6: DISTRIBUTION OF PATIENTS ACCORDING TO TYPE OF HIP SURGERY

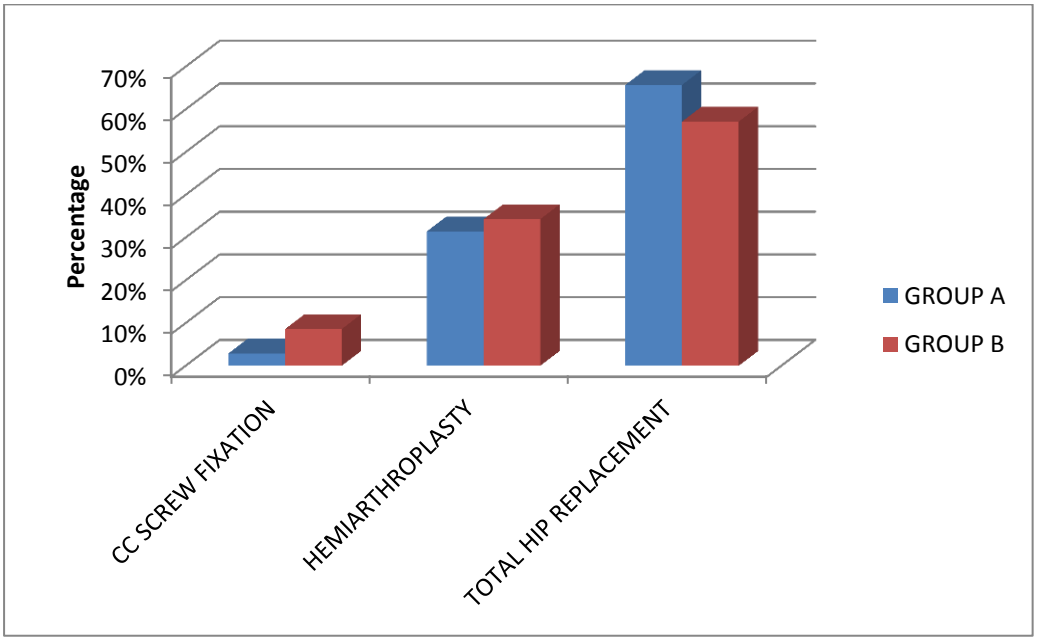


TABLE 5: MEAN DURATION OF ANALGESIA (in hours)

	Group A		Group B		Z	p-value
	Mean	SD	Mean	SD		
Duration of analgesia (in hours)	2.77	1.06	12.24	5.14	-7.226	**0.001**

Mean duration of analgesia was defined as the time from shifting the patient to post anaesthesia care unit (PACU) to the time of first requirement of rescue analgesic at VAS ≥4.

The mean duration of analgesia was 2.77±1.06 hours in group A and 12.24±5.14 hours in group B. The difference was statistically significant among both groups.

Four patients of group B never complained of pain at any point of time during 24 hours with VAS ranging between 0-1.

FIGURE 7: MEAN DURATION OF ANALGESIA (in hours)

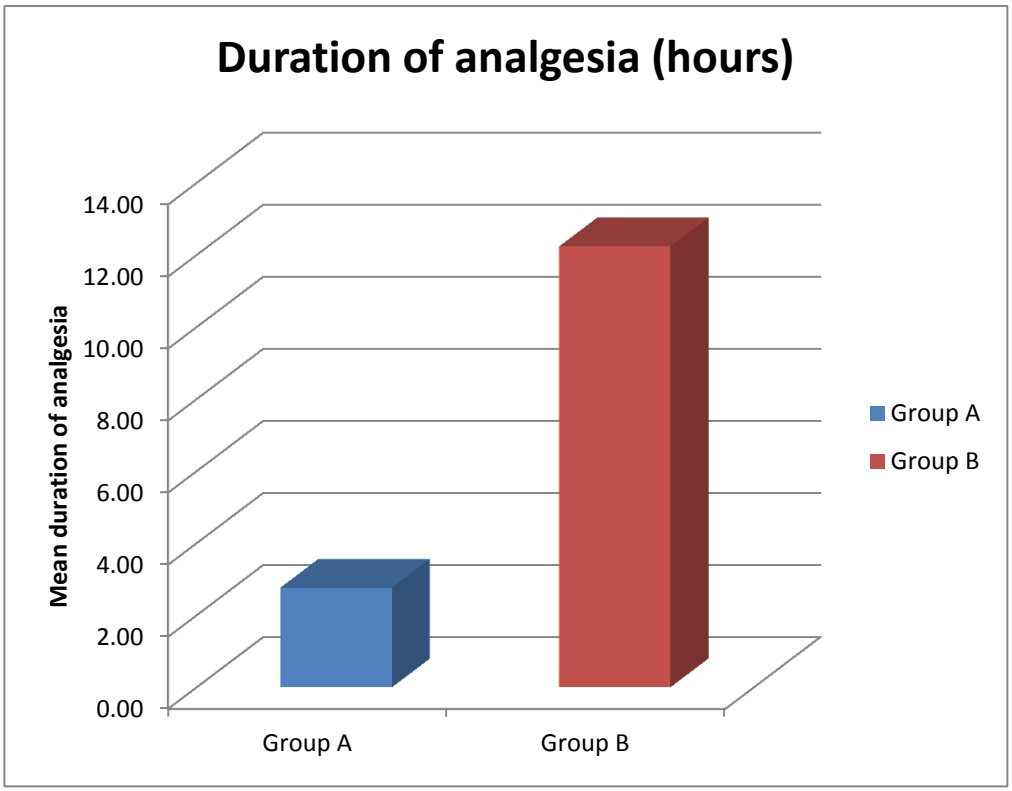


TABLE 6: TRENDS IN MEAN VAS SCORE AT REST IN PACU

VAS AT REST	Group A		Group B		Z	p-value
	Mean	SD	Mean	SD		
BASELINE	3.17	1.04	3.34	1.21	-0.635	0.528
0 min	3.23	0.84	2.74	1.22	1.937	0.057
1 hour	3.51	0.70	2.71	1.13	3.566	**0.001**
2 hours	4.03	1.10	2.83	1.04	4.689	**0.001**
3 hours	4.03	0.66	2.89	1.08	5.340	**0.001**
4 hours	4.14	0.88	3.09	0.95	4.829	**0.001**
6 hours	4.20	0.87	3.40	0.74	4.160	**0.001**
8 hours	4.26	1.07	3.91	1.17	1.280	0.205
12 hours	4.43	0.92	3.86	1.19	2.249	**0.028**
16 hours	4.34	0.94	3.54	1.01	3.434	**0.001**
20 hours	4.14	1.03	3.37	1.06	3.084	**0.003**
24 hours	4.14	1.24	3.49	0.92	2.518	**0.014**

Statistically significant reduced VAS scores were observed at rest in group B at all measurement time point of the study except at the 8th hour where the mean VAS scores were comparable in both groups.

FIGURE 8: TRENDS IN MEAN VAS SCORE AT REST IN PACU

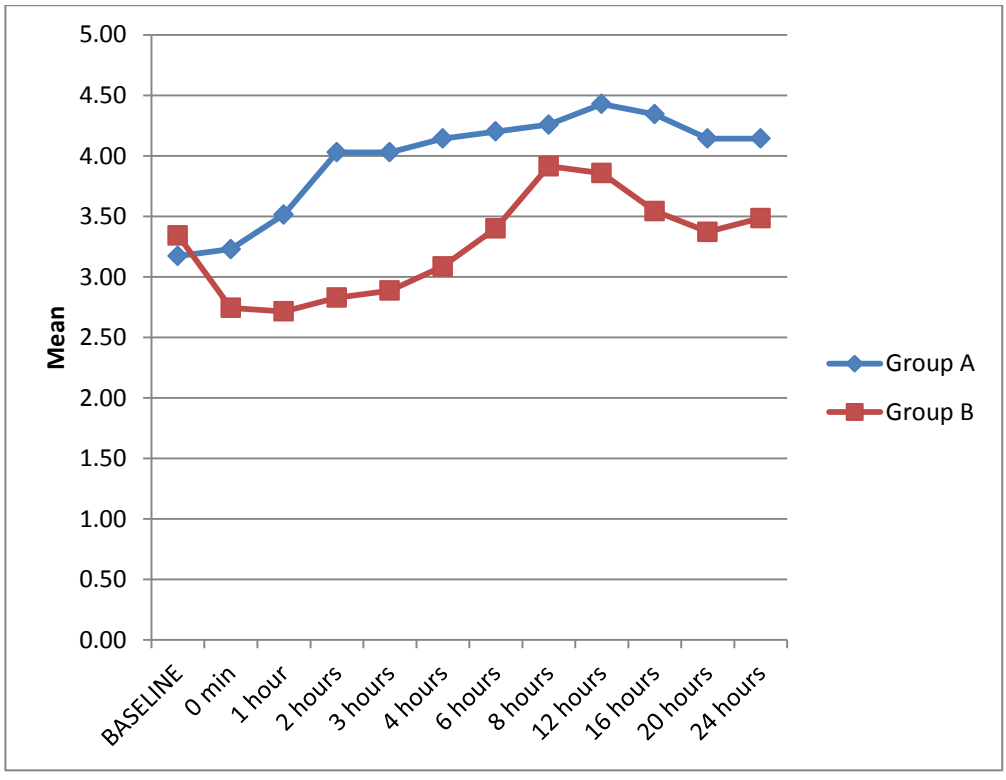


TABLE 7: TRENDS IN MEAN VAS SCORE ON DYNAMIC HIP MOVEMENT IN PACU

VAS ON DYNAMIC HIP MOVEMENT	Group A		Group B		Z	p-value
	Mean	SD	Mean	SD		
BASELINE	4.14	1.17	4.26	1.36	-0.378	0.707
0 min	3.89	0.58	3.40	1.12	2.281	**0.026**
1 hour	4.09	0.61	3.40	0.91	3.688	**0.001**
2 hours	4.63	1.03	3.54	0.78	4.967	**0.001**
3 hours	4.51	0.92	3.74	0.70	3.948	**0.001**
4 hours	4.86	1.12	3.63	0.60	5.743	**0.001**
6 hours	4.89	1.08	3.91	0.74	4.389	**0.001**
8 hours	4.74	1.15	4.60	1.24	0.500	0.619
12 hours	5.03	1.15	4.43	1.14	2.187	**0.032**
16 hours	4.83	1.10	4.17	0.95	2.673	**0.009**
20 hours	4.66	1.03	4.11	1.05	2.185	**0.032**
24 hours	4.71	1.20	4.14	0.77	2.366	**0.021**

Statistically significant decreased VAS scores were observed on dynamic hip movement in group B at all measurement time point of the study except at the 8th hour where the mean VAS scores were comparable in both groups.

FIGURE 9: TRENDS IN MEAN VAS SCORE ON DYNAMIC HIP MOVEMENT IN PACU

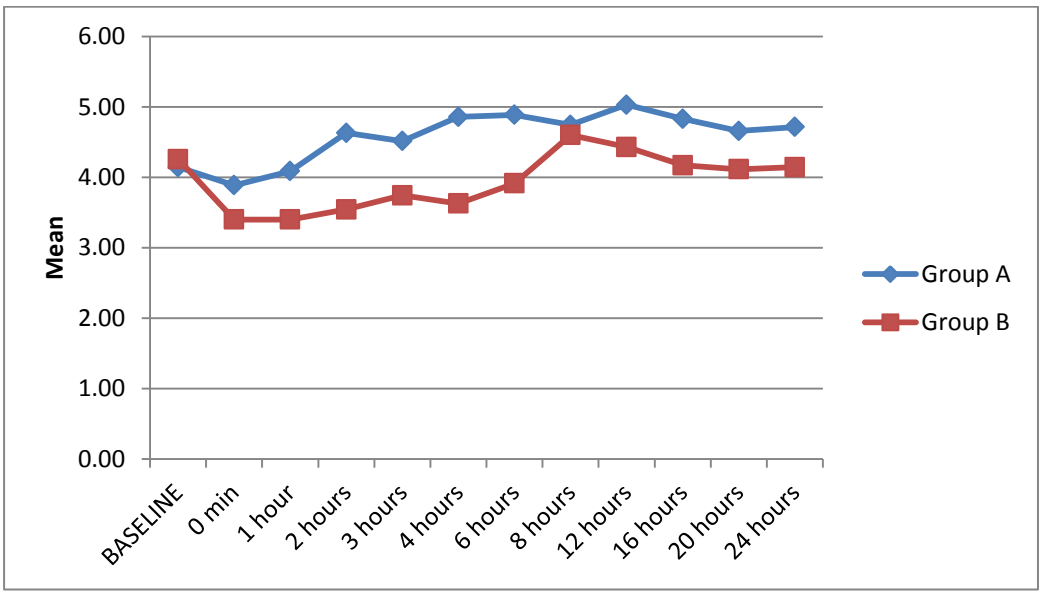


TABLE 8: MEDIAN (IQR) ANALGESIC CONSUMPTION IN 24 HOURS POST- OPERATIVELY

	Group A		Group B		Z	p-value
	Median	IQR	Median	IQR		
Total amount of rescue analgesic used in 24 hours period(mg)	150	100-150	50	50-100	-5.921	**0.001**

Median values of total rescue analgesic consumption in the 24 hours post-operative period was significantly less in group B than in group A patients (with p value (p=0.001)

FIGURE 10: MEDIAN (IQR) ANALGESIC CONSUMPTION IN 24 HOURS POST-OPERATIVELY

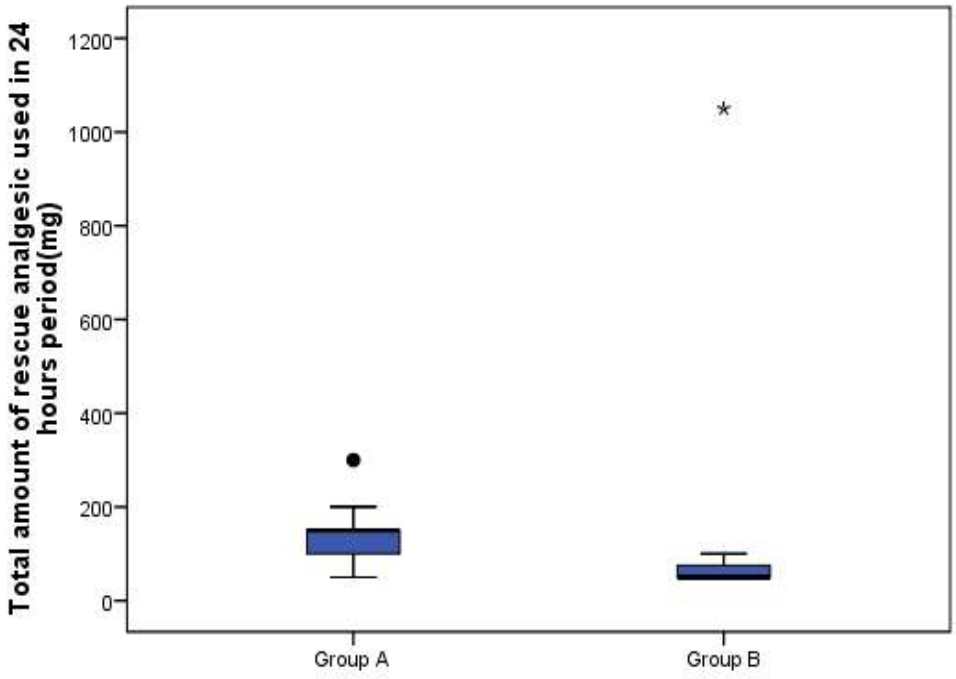
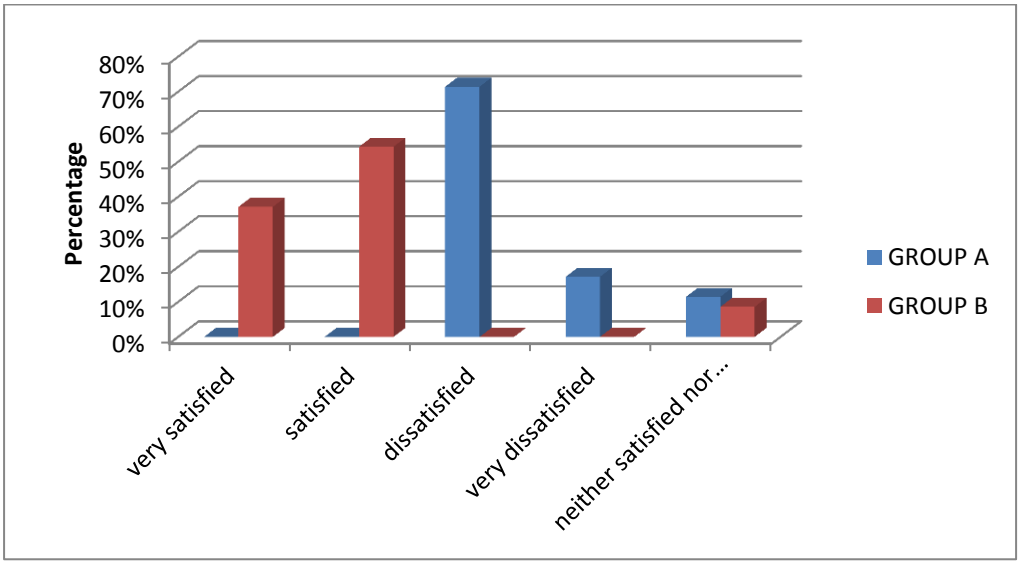


TABLE 9: QUALITY OF BLOCK AS ASSESSED BY PATIENT SATISFACTION SCORE AT THE END OF 24 HOURS POST-OPERATIVELY

		GROUP A		GROUP B		Total	Chi-square value	p-value
		GROUP A	GROUP A	GROUP B	GROUP B			
Overall patient satisfaction	**very satisfied**	0	0%	13	37%	13	63.143	**0.0001**
	satisfied	0	0%	19	54%	19		
	dissatisfied	25	71%	0	0%	25		
	very dissatisfied	6	17%	0	0%	6		
	neither satisfied nor dissatisfied	4	11%	3	9%	7		
	Total	35	100%	35	100%	70		

In group A, 71%,17% and 11% subjects were dissatisfied, very dissatisfied and respectively while in group B, 37% and 54% subjects were very satisfied and satisfied respectively with only 9% of subjects who were neither satisfied nor dissatisfied

FIGURE 11: QUALITY OF BLOCK AS ASSESSED BY PATIENT SATISFACTION SCORE AT THE END OF 24 POST-OPERATIVELY



DISCUSSION

Post- operative pain relief following hip surgeries has been a challenge for anaesthesiologists, as pain-free dynamic movements are essential to fast tracking early rehabilitation. Peripheral nerve blocks (PNB's) can efficiently reduce pain associated with hip fracture. They also contribute to reduced rates of delirium, respiratory depression, nausea, vomiting and motor blockade which are the most common side effects seen with parenteral opioids and central neuraxial blocks.[2,3] Multiple techniques of PNB like FNB, FICB and sciatic nerve block provide good analgesia but cause motor blockade leading to delayed ambulation and patient discharge from PACU.[17] Also, incomplete coverage of sensory nerves innervating the hip is consistently seen with these nerve blocks. Hence it is important to revisit the nerve supply of anterior capsule of hip.

The innervation of the hip and lower extremity is derived from the lumbosacral plexus. The anterior capsule of hip which has the richest nerve supply is mainly supplied by FN, AON and ON.[20] It has been observed that PENG block targets only the articular branches of the FN, ON and AON thereby alleviating pain considerably with superior motor sparing thus minimizing the use of opioids in post-operative period and permitting early ambulation and recovery. This regional anaesthetic technique was described in 2018 and developed primarily for total hip arthroplasties for postoperative analgesia.[19]

The successful use of PENG block in isolation or in conjugation with other blocks have been published as various case reports/ case series and few randomized control trials.[23,24,25,33,38,48] Authors of these studies have successfully used varying volumes and concentrations of local anaesthetic solution and hence the volume which could provide adequate analgesia especially on dynamic hip movement still warrants further investigation.

Our study aimed to evaluate the post- operative analgesic efficacy of PENG block using 10ml versus 20ml of local anaesthetic solution (0.2% ropivacaine) in terms of mean duration of analgesia, VAS scores both at rest and dynamic hip movement, total 24 hours consumption of rescue analgesic and patient satisfaction scores in patients undergoing hip surgeries under GETA or GA-LMA.

We chose to use 0.2% ropivacaine due to its significantly low neurotoxic and cardiotoxic potential. In addition, it results in a lower incidence of motor blockade secondary to greater degree of motor sensory differentiation, thereby further supporting early mobilization and safety in post-operative period.[26]

In our study, both the groups were statistically comparable in respect to demographic profile, type and duration of surgery and anaesthesia. In addition we chose to conduct our study under GETA so as to offset any analgesic or motor block effect of spinal anaesthesia in post- operative period. Hence, the comparable confounders did not have to ability to bias our results.

The mean duration of analgesia, defined as the time from shifting the patient to post anaesthesia care unit (PACU) to the time of first requirement of rescue analgesic at VAS ≥4, in our study was significantly prolonged in group B (12.24±5.14 hours) than in group A (2.77±1.06 hours). We observed statistically significant decreased VAS scores on rest and on dynamic hip movement in group B at predominantly all measurement time points of the study in the postoperative period. In addition, the median total rescue analgesic consumption in the 24-hour post-operative period was significantly lower in group B. These findings imply superior analgesic efficacy of 20ml over 10ml of 0.2% ropivacaine in PENG block.

Our findings are consistent with previously published case reports and retrospective case series.[19,21,22,49] Kukreja P et al administered PENG block using 20 ml of 0.5% ropivacaine and observed lower average

VAS scores in patients undergoing primary THA as compared to pain scores after revision THA. They also reported significantly reduced cumulative oral morphine equivalent usage up to 24 hours post operatively, thus concluding that PENG block can be used as an alternative to FNB or lumbar plexus block for primary THA.[21] In a retrospective case series comprising of 123 patients undergoing THA, Mysore et al compared analgesic efficacy of adding PENG block to local infiltration anaesthesia (LIA) and multimodal analgesia for THA. They found that PENG block +LIA was associated with a 2.4 mg reduction in 24 hour hydromorphone consumption than those who received only LIA.[49]

The findings of our study are in concordance with the interpretations from retrospective case series and other case reports. In fact, our observations have validated the analgesic effects of PENG block observed by for the first time by Giron et al in 2018.[19] They proposed that the analgesic effects occur because of the selective blockade of the articular branches of FN and AON with resultant sparing of their motor components. The authors stated that the nerve supply from ON, AON and high branches of the FN contribute greatly to the anterior capsule of hip joint. Indeed, Giron et al incorporated the observations from the anatomical study by Short et al to develop this ultrasound guided Pericapsular nerve group block (PENG block) for blocking the articular branches of ON, AON & FN to hip, which were seen to traverse close to the periosteum between ilio- pubic eminence (IPE) and anterior inferior lilac spine (AIIS).[19]

During the course of our study three randomized control trials have been published among which Pascarella et al evaluated the impact of PENG block versus no block on post- operative analgesia and functional recovery following THA with the use of 20ml of 0.3% ropivacaine.[23] The maximum post- operative pain score and opioid consumption in patients receiving PENG block was significantly lower at all time points and were comparable to the results of our study.

However these authors included THA conducted via the posterior approach[23] while our study included all surgeries irrespective of its approach, thereby proving versatility of the analgesic efficacy of PENG block for hip surgeries. In addition we assessed pain scores at rest and dynamic hip movement which can be considered as indirect indicators of the motor sparing effect of PENG block.

The remainder two randomized control trials have evaluated PENG with other PNBs for hip fractures.[24,25] The results of our study in regard to post- operative pain scores on dynamic hip movement are in concordance to the findings of Lin D et al and Aliste J et al. The double blinded randomised comparative trials of Lin D et al and Aliste et al utilised 20ml of 0.75% ropivacaine and 20ml of 0.5% levobupivacaine respectively as local anaesthetic solution for PENG block while comparing them with alternative PNB's (FICB/FNB). They observed significantly less post-operative pain with better sparing of quadriceps strength in patients who received PENG block.

An ideal regional nerve block technique for hip surgery should entail substantial reduction in dynamic pain scores along with significant opioid sparing, full preservation of motor function and consequent higher degree of patient satisfaction.

Patient satisfaction is an important parameter which reflects the quality of pain relief especially on dynamic movements. Lin D et al reported significantly improved patient satisfaction scores (97%) in the PENG group.[24] Comparable patient satisfaction scores were observed in group B of our study (91%) demonstrating the remarkable quality of enhanced pain relief achieved with 20ml volume of local anaesthetic solution.

Lin D et al and Aliste J et al reported no intergroup differences in opioid consumption upto 24-48 hours post-operative period. However, the results of our study elicited statistically significant decreased median total rescue analgesic (tramadol+ fentanyl) consumption in the 24 hour

post- operative period in patients who received 20ml of local anaesthetic solution (group B). These differences in the results for opiate consumption could be ascribed to comparative use of different volumes of local anaesthetic solutions in the two groups of our study receiving PENG block, in contrary to adequate volumes of LA solutions used for both PENG and alternative comparator blocks ((FNB and supra inguinal FICB) in the studies by Lin D et al and Aliste J et al. Perhaps this may indicate that 10ml of 0.2% ropivacaine used in group A of our study was inadequate necessitating use of increased dosages of rescue analgesics.

Studies by Aliste J et al and Lin D et al score over our study in objectively quantifying post- operative quadriceps strength by using objective knee extension grades and hip adduction scores. Compared with supra-inguinal FICB, PENG block resulted in lower incidence of quadriceps motor block and decreased incidence of paresis/paralysis of hip adduction at 3 and 6 hours.[25] Similarly Lin D et al reported significantly better maintained quadriceps strength on post- operative day 0 and day 1 in PENG group compared to FNB group.[24] Better preserved quadriceps strength permits early ambulation, with likely faster recovery and shorter length of stay in hospital, thereby aiding in fast tracking hip surgery patients.

However both the above studies caution on the possibility of residual or some impairment in quadriceps muscle strength following PENG block[24,25] which could be attributed to either a large volume of local anaesthetic used spreading to the FN or ON especially if the needle tip is positioned medially along the IPE , or to the use of higher concentration of local anaesthetic (20ml of 0.75% ropivacaine by Lin D et al) or secondary to the residual effect of spinal anaesthesia used as a primary anaesthesia technique in some studies.

Though we did not assess quadriceps strength using knee extension grades and hip adduction scores nevertheless we evaluated pain scores on dynamic hip movement (performed by asking the patients to

flex at the hip and to perform a straight leg raise of the affected limb to 15 degrees) which reflects as a surrogate of quadriceps strength. We acknowledge that future studies need to employ objective grades/scores to quantify the motor sparing effect of PENG block.

Furthermore the pain arising from skin incisions of hip surgeries can be diminished by blocking the lateral femoral cutaneous nerve, lateral cutaneous branches of ilio-hypogastric and subcostal nerves. Addition of these nerve blocks to PENG block may offer painless perioperative sojourn for patients undergoing hip surgeries.[58]

There are a few limitations in our study that are worth mentioning. First three different types of surgeries were performed by different surgeons, thus causing the differences in surgical approach, tissue handling and operative time which could have influenced intensity of pain amongst our subjects.

Despite the limitations, our study design offered few advantages: All observations were carried out by a single observer to eliminate any inter observer variability and the PENG block was administered only by three experienced consultant anaesthesiologists to all the subjects of our study. Secondly all our patients underwent hip surgeries under GETA or GA-LMA anaesthesia so we could independently evaluate post-operative analgesic efficacy of PENG block and circumvented any confounding factors from the residual effects of central neuraxial techniques. In addition, GETA helped us in blinding the patients as well.

We thus conclude from the results of our study that 20 ml of 0.2% Ropivacaine in PENG block provides significantly longer duration of analgesia, statistically significant reduction in pain scores on rest and dynamic hip movement with substantially decreased 24 hour total rescue analgesic consumption and improved patient satisfaction in patients undergoing hip surgeries.

SUMMARY & CONCLUSION

The present study was conducted in the department of Anaesthesiology, Dayanand Medical College and Hospital, Ludhiana after getting approval from the Institutional Ethical Committee. The aim was to compare the analgesic efficacy of USG guided PENG block using 10ml versus 20ml of 0.2% ropivacaine for post-operative pain relief after hip surgeries. Seventy patients belonging to ASA grade I, II or III scheduled for hip surgeries under GETA or GA-LMA were included in a randomized, double blind manner after obtaining a written informed consent. Patients were randomly allocated using computer generated random numbers to either of the two groups to receive:

GROUP A:

Comprising of 35 patients each who received 10 ml of 0.2% Ropivacaine in PENG block

GROUP B:

Comprising of 35 patients each who received 20 ml of 0.2% Ropivacaine in PENG block

The block was performed under USG using a high frequency curvilinear probe with patient in supine position by a group of 3 experienced anaesthesiologists after administration of general anaesthesia.

After administration of PENG block, patients were assessed for mean duration of analgesia, VAS scores at rest and dynamic hip movement, total 24 hour rescue analgesic requirement and patient satisfaction score. Results were analysed statistically.

We observed that 1) mean duration of analgesia was significantly prolonged in group B (12.24±5.14 hours) than in group A (2.77±1.06 hours) 2) VAS scores at rest and on dynamic hip movement were statistically significant at all measurement time points of the study except at the 8^{th} hour where the mean VAS scores were comparable in both groups. 3) the median total rescue analgesic consumption in the

24 hours post-operative period was significantly less in group B than in group A patients (with p value (p=0.001) 4)Also the quality of block assessed by patient satisfaction score was significantly better in group B.

Hence, from the results of our study we conclude that 20ml of 0.2% Ropivacaine in PENG block is efficacious in significantly reducing dynamic hip pain in post-operative period after hip surgeries.

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Sr No	MRD No	ENROLLMENT DATE	Age	Gender	Height	Weight(kg)	BMI	TYPE OF HIP SURGERY	ASA grade	Comorbidities	GROUP ALLOCATION	Haemoglobin (Hb)	Total leucocyte count (TLC)	Platelets
1	327121	23-11-2019	61	M	172	85	28.5	RIGHT HEMIARTHROPLASTY	3	HTN,DM,alcoholic	B	12.8	6.9	157
2	858575	30-11-2019	72	F	165	55	20.2	RIGHT TOTAL HIP REPLACEMENT	2	NONE	A	11.1	11.7	206
3	864883	12-12-2019	80	F	157	60	24.2	LEFT HEMIARTHROPLASTY	2	HTN,HEP C	B	12	6.8	259
4	870456	24-12-2019	58	F	167	80	28.5	LEFT TOTAL HIP REPLACEMENT	2	HTN	A	11.7	8	140
5	447492	28-12-2019	66	F	165	75	27.5	RIGHT TOTAL HIP REPLACEMENT	2	HTN,CVA	B	13.6	8.8	288
6	742962	01-11-2020	70	F	152	40	17.2	LEFT HEMIARTHROPLASTY	3	B CELL LYMPHOMA, HTN,DM2	B	10.1	2.5	100
7	876678	06-01-2020	80	F	157	50	20.2	RIGHT HEMIARTHROPLASTY	2	HTN,DM2	B	12.8	6.54	168
8	747210	08-01-2020	58	M	175	80	26	LEFT TOTAL HIP REPLACEMENT	2	DM2, PSEUDOANEURYSM OF FEMORAL ARTERY	B	14.4	8200	322
9	878084	09-01-2020	45	F	157	65	26.2	CC SCREW FIXATION	1	NONE	A	11.4	7.4	270
10	879415	10-01-2020	65	F	157	80	32.3	LEFT HEMIARTHROPLASTY	2	HTN	B	12.5	7.7	384
11	417021	24-01-2020	38	F	160	70	27.3	RIGHT TOTAL HIP REPLACEMENT	2	ON ANTICOAGULANTS	B	12.3	7.6	397
12	892480	18-02-2020	60	M	175	75	24.2	RIGHT TOTAL HIP REPLACEMENT	2	HTN	A	13.1	7.7	290
13	901944	22-02-2020	46	M	162	63	23.8	RIGHT TOTAL HIP REPLACEMENT	2	CHRONIC SMOKER	B	12.4	9.4	232
14	906327	20-02-2020	38	M	177	80	25.3	LEFT CC SCREW	2	POLIOMYELITIS, PULMONARY TB	B	14.3	7.6	260
15	94800	29-02-2020	52	M	162	60	22.7	LEFT HEMIARTHROPLASTY	1	NONE	B	9.7	7.5	291
16	734547	05-03-2020	60	F	157	55	22.2	RIGHT TOTAL HIP REPLACEMENT	3	HTN,CAD,DM2	A	10.2	10.4	280
17	200557	17-03-2020	42	F	162	90	34.1	RIGHT TOTAL HIP REPLACEMENT	2	HTN	A	9.3	17.2	347
18	919271	19-03-2020	42	M	170	80	27.6	RIGHT CC SCREW	2	DEPRESSIVE ILLNESS	B	15.2	10.7	276
19	913722	20-05-2020	54	M	165	70	25.7	RIGHT HEMIARTHROPLASTY	2	DM2	A	11.9	8.8	239
20	930496	02-06-2020	74	F	152	70	30.1	RIGHT HEMIARTHROPLASTY	2	DM2	B	12.1	13	120
21	919373	23-06-2020	26	M	165	50	18.3	RIGHT TOTAL HIP REPLACEMENT	2	HCV,HBV,CHRONIC ALCOHOLIC	A	12.9	5.2	307
22	919043	23-06-2020	39	M	162	50	21.9	RIGHT HEMIARTHROPLASTY	1	NONE	B	16.2	6.6	150
23	644838	10-07-2020	60	M	177	68	21.5	RIGHT TOTAL HIP REPLACEMENT	2	OCCASIONAL ALCOHOLIC	A	15.3	8.3	193
24	902250	22-07-2020	45	M	172	78	26.1	RIGHT TOTAL HIP REPLACEMENT	2	HCV	B	9.9	10.6	180
25	946720	24-07-2020	29	M	175	60	19.5	RIGHT TOTAL HIP REPLACEMENT	1	NONE	B	12.6	11.2	352
26	951086	07-08-2020	37	M	170	68	23.5	RIGHT HEMIARTHROPLASTY	2	POLIOMYELITIS	A	13.7	6.9	200
27	428307	14-08-2020	65	M	172	75	25.1	RIGHT TOTAL HIP REPLACEMENT	2	CHRONIC ALCOHOLIC	A	14.5	6.5	146
28	957881	23-08-2020	29	M	180	80	24.6	RIGHT HEMIARTHROPLASTY	2	CHRONIC ALCOHOLIC	A	14.4	9.8	160
29	338281	10-09-2020	50	M	162	61	23.1	RIGHT HEMIARTHROPLASTY	3	ANAEMIA,TCP,NASH WITH PORTAL HTN	B	10.2	5.5	350
30	872385	01-10-2020	44	M	180	80	24.6	LEFT HEMIARTHROPLASTY	3	ANAEMIA,TCP,DM2,CLD	A	9.4	4.5	500
31	974937	14-10-2020	56	M	172	80	26.8	LEFT HEMIARTHROPLASTY	1	NONE	B	15.3	7	195
32	983630	06-11-2020	68	M	172	60	23.4	RIGHT HEMIARTHROPLASTY	2	HTN	A	11.6	7.5	220
33	172232	22-12-2020	43	F	152	65	28	LEFT HEMIARTHROPLASTY	3	K/C/O BREAST CABCER, ANAEMIA	A	9	7	281
34	1009805	08-01-2021	82	M	170	62	21.4	RIGHT HEMIARTHROPLASTY	2	HTN	A	11.2	13.3	202
35	946720	09-01-2021	29	M	165	61	22.4	LEFT TOTAL HIP REPLACEMENT	2	HTN	B	13.2	9.2	281
36	910472	05-02-2021	48	F	167	70	24.9	LEFT TOTAL HIP REPLACEMENT	2	ANAEMIA	B	9.7	7.4	225
37	1030653	19-02-2021	52	M	177	85	26.9	RIGHT TOTAL HIP REPLACEMENT	1	NONE	A	14.1	10.1	194
38	993647	20-02-2021	38	M	175	63	20.5	RIGHT TOTAL HIP REPLACEMENT	2	DM2	A	13.5	5.6	970
39	1032010	21-02-2021	56	F	162	70	26.5	RIGHT HEMIARTHROPLASTY	2	HTN, DERRANGED RFT's	A	9.2	6.4	130
40	1032582	23-02-2021	43	M	162	62	23.5	RIGHT TOTAL HIP REPLACEMENT	2	CHRONIC ALCOHOLIC	A	13.5	6	120
41	1042246	06-03-2021	69	F	149	57	25.4	RIGHT TOTAL HIP REPLACEMENT	2	HTN	B	7	8.8	517
42	758794	09-03-2021	41	M	172	80	26.8	LEFT TOTAL HIP REPLACEMENT	1	NONE	A	13.9	6	125
43	1046352	11-03-2021	33	F	160	55	21.5	RIGHT TOTAL HIP REPLACEMENT	1	NONE	B	9.8	9.4	124
44	858189	16-03-2021	48	M	172	80	26.8	RIGHT TOTAL HIP REPLACEMENT	3	ANAEMIA, TCP	A	7.6	2.6	68
45	529134	10-03-2021	76	F	157	65	26.2	LEFT TOTAL HIP REPLACEMENT	2	HTN, K/C/O BREAST CANCER	B	11.6	8.9	274
46	1091393	22-04-2021	72	M	170	80	27.6	RIGHT TOTAL HIP REPLACEMENT	2	HTN	B	9	2.7	250
47	975947	02-06-2021	65	M	172	70	23.5	RIGHT TOTAL HIP REPLACEMENT	2	HTN, POST COVID	B	12.7	5.2	156
48	1119360	03-06-2021	57	F	165	75	27.5	RIGHT TOTAL HIP REPLACEMENT	3	HTN,DM2	A	12.9	8.3	344
49	1079475	08-06-2021	75	M	177	70	22.1	LEFT TOTAL HIP REPLACEMENT	2	HTN,DM2,HYPERKALEMIA	B	9	7.9	219

Sr No	MRD No	Duration of Anaesthesia in minutes (time from anaesthesia induction to uneventful	Duration of surgery in minutes (time from skin incision to closure)	1st VAS recording (on rest) when rescue analgesia was given (out of 10)	1st VAS recording (on dynamic movememt) when rescue analgesia was given (out of 10)	VAS (AT REST)											
						BASELINE	0 min	1 hour	2 hours	3 hours	4 hours	6 hours	8 hours	12 hours	16 hours	20 hours	24 hours
1	327121	210	195	0	0	6	1	2	2	2	3	2	2	1	1	2	2
2	858575	240	195	5	7	4	4	4	3	4	5	3	2	4	5	3	4
3	864883	210	195	5	6	4	0	1	1	2	2	3	4	5	4	3	3
4	870456	165	150	5	6	4	0	5	4	3	2	5	6	5	3	2	2
5	447492	210	195	4	5	4	0	0	1	1	3	3	4	3	3	2	2
6	742962	225	210	5	5	3	1	1	2	2	3	5	1	4	2	2	3
7	876678	120	90	5	6	3	0	0	1	0	1	2	2	3	5	3	3
8	747210	315	300	0	0	4	0	0	0	1	1	2	2	2	2	1	2
9	878084	160	135	6	7	3	2	2	1	3	6	3	3	5	4	3	2
10	879415	150	135	5	6	3	3	2	2	1	2	4	5	3	2	2	3
11	417021	180	135	5	6	2	3	2	2	3	4	3	5	3	4	5	3
12	892480	180	135	5	6	5	4	3	3	5	5	4	3	5	5	6	5
13	901944	210	180	5	7	5	4	3	3	4	3	3	5	5	4	3	3
14	906327	120	90	0	0	4	3	3	2	2	2	3	3	4	4	3	3
15	94800	150	120	3	5	6	4	4	3	3	2	3	3	2	3	3	3
16	734547	120	90	5	6	3	3	3	3	3	4	5	4	3	3	3	2
17	200557	210	180	4	5	6	3	3	4	4	5	5	6	6	6	6	6
18	919271	180	150	0	0	5	2	3	2	2	1	2	2	2	2	3	3
19	913722	120	90	5	7	4	2	3	5	3	4	3	3	5	3	3	4
20	930496	120	90	5	6	6	3	3	3	3	4	3	4	3	5	5	4
21	919373	180	150	5	5	6	3	5	4	4	5	5	4	6	6	6	7
22	919043	150	135	5	6	4	3	3	3	2	3	4	4	5	4	4	3
23	644838	165	150	5	6	4	4	4	3	5	4	4	5	4	4	5	6
24	902250	210	180	5	5	2	4	3	3	4	3	3	4	4	3	5	5
25	946720	180	150	5	6	2	3	3	3	3	4	4	3	3	4	5	5
26	951086	150	135	6	6	3	3	4	6	4	4	5	4	4	4	6	5
27	428307	120	105	5	6	3	3	4	4	5	4	4	3	4	5	4	4
28	957881	90	75	5	6	2	3	3	3	5	4	3	4	4	5	5	3
29	338281	120	105	5	6	2	3	3	3	4	4	3	4	5	4	3	4
30	872385	150	135	4	5	2	3	4	4	4	3	3	5	3	4	5	3
31	974937	120	105	5	6	3	4	4	4	4	3	3	4	4	5	4	5
32	983630	120	110	4	5	3	3	3	4	3	4	3	4	3	5	3	3
33	172232	180	165	5	6	3	4	4	5	3	3	5	3	4	6	4	6
34	1009805	150	135	6	6	3	4	3	6	4	4	5	6	4	4	5	5
35	946720	180	180	6	6	3	3	4	4	3	4	4	6	5	4	4	5
36	910472	120	90	5	6	3	4	3	3	3	4	4	5	4	4	3	4
37	1030653	180	165	5	6	3	4	3	5	4	3	5	4	3	3	4	4
38	993647	180	150	5	6	2	3	5	4	4	4	5	3	4	5	4	3
39	1032010	150	120	5	6	3	4	3	4	5	3	4	5	3	3	4	3
40	1032582	210	180	5	6	2	3	4	3	5	3	4	4	5	4	3	5
41	1042246	180	165	6	7	2	3	3	4	4	4	4	6	5	4	6	5
42	758794	150	120	6	6	2	4	3	3	4	6	5	4	6	5	5	4
43	1046352	120	120	6	6	2	3	3	4	4	3	4	4	6	3	4	3
44	858189	180	165	6	7	3	4	3	6	4	3	4	6	4	3	3	3
45	529134	180	150	6	7	2	3	3	4	2	3	3	3	2	6	4	4
46	1091393	180	165	5	6	3	4	4	4	3	4	4	5	4	3	2	3
47	975947	165	150	5	6	2	3	3	4	3	3	4	5	3	3	4	3
48	1119360	210	180	5	6	3	3	4	5	4	4	4	4	6	4	4	3
49	1079475	120	105	5	6	3	3	2	2	3	3	3	4	5	4	3	3

Sr No	MRD No	VAS (AT DYNAMIC HIP MOVEMENT)												Total amount of rescue analgesic used in 24 hours period (mg)	Time of arrival in PACU	Time at which VAS is ≥ 4 for the first time post-operatively	Duration of analgesia (hours)	Overall patient satisfaction
		BASELINE	0 min	1 hour	2 hours	3 hours	4 hours	6 hours	8 hours	12 hours	16 hours	20 hours	24 hours					
1	327121	7	2	2	3	3	3	2	3	2	2	3	3	0	1pm	never	24	very satisfied
2	858575	6	4	4	4	4	7	4	3	4	6	4	4	100	2pm	6pm	3	neither satisfied nor dissatisfied
3	864883	5	0	2	2	3	3	3	4	6	4	4	4	50	12pm	11pm	12	satisfied
4	870456	6	1	6	5	2	3	7	7	6	4	3	3	100	1:45pm	2:30pm	0.75	dissatisfied
5	447492	6	1	1	2	2	4	4	5	3	4	3	3	50	12pm	8pm	10	neither satisfied nor dissatisfied
6	742962	4	2	2	2	3	3	5	2	5	3	3	4	1050	3pm	9pm	6	satisfied
7	876678	4	1	1	2	2	2	3	3	4	6	4	4	50	1pm	3am	14	very satisfied
8	747210	5	1	2	2	3	2	3	3	3	3	2	3	0	3:30pm	never	24	very satisfied
9	878084	5	4	3	3	4	7	4	4	6	4	4	3	100	3:45pm	7:45pm	4	neither satisfied nor dissatisfied
10	879415	6	4	3	4	3	3	6	6	4	3	3	3	50	10pm	5:30am	7.3	satisfied
11	417021	3	4	3	3	4	4	4	6	4	4	6	4	100	12:15pm	8:15pm	8	neither satisfied nor dissatisfied
12	892480	6	4	4	4	6	5	5	4	6	6	7	6	200	1pm	4pm	3	dissatisfied
13	901944	6	4	4	4	4	4	4	7	3	4	4	4	50	6pm	3am	13	satisfied
14	906327	5	4	4	3	3	3	3	4	4	4	4	4	0	12pm	Never	24	very satisfied
15	94800	7	4	4	4	4	3	4	5	3	4	4	4	50	12pm	9pm	9	satisfied
16	734547	5	4	4	4	4	5	6	3	3	3	4	4	50	2pm	7pm	5	neither satisfied nor dissatisfied
17	200557	7	4	4	4	5	7	7	7	7	7	7	8	300	12:15pm	3:15pm	3	dissatisfied
18	919271	6	3	3	3	3	3	2	3	3	4	3	4	0	11pm	Never	24	very satisfied
19	913722	5	3	3	7	4	4	4	5	6	4	4	4	100	11:30am	1:15pm	2.15	dissatisfied
20	930496	7	4	4	4	5	4	4	5	4	6	7	5	50	12:30pm	2:30am	14	very satisfied
21	919373	7	4	5	5	4	6	4	3	4	4	4	4	150	12:30pm	1:45pm	1.15	dissatisfied
22	919043	4	4	3	3	4	4	4	5	6	4	4	4	50	3:45pm	3am	12	satisfied
23	644838	5	4	4	4	6	5	5	6	5	4	6	7	200	11:45am	3pm	2.15	neither satisfied nor dissatisfied
24	902250	3	4	4	4	4	4	4	3	4	4	5	5	100	1pm	10am	16	very satisfied
25	946720	3	3	4	4	4	4	4	4	4	4	6	6	100	12pm	9am	20	very satisfied
26	951086	4	4	4	6	4	4	6	5	4	4	6	5	200	12:30pm	2pm	2	dissatisfied
27	428307	4	4	4	4	6	4	4	4	6	6	5	4	150	11am	2pm	3	dissatisfied
28	957881	3	4	4	4	6	4	4	4	4	6	6	4	150	1pm	3:30pm	2.3	dissatisfied
29	338281	3	4	4	4	4	4	4	4	6	4	4	5	100	3:30pm	2:30am	12	satisfied
30	872385	3	3	4	4	5	4	4	6	4	4	6	4	150	12:30pm	3pm	2.3	dissatisfied
31	974937	4	4	3	4	4	4	4	4	4	6	5	6	100	12:15pm	3am	15	satisfied
32	983630	4	4	4	4	4	5	4	4	4	6	4	4	100	11:40am	3pm	3	dissatisfied
33	172232	4	4	4	6	4	4	7	4	4	7	4	7	200	12:45pm	3pm	2	very dissatisfied
34	1009805	4	4	4	6	4	5	5	6	5	5	5	5	100	5pm	6:30pm	2	dissatisfied
35	946720	4	4	4	4	4	4	4	6	5	5	4	5	50	1pm	8pm	7	satisfied
36	910472	3	4	4	4	4	4	4	6	5	5	4	5	50	11:45am	6:45pm	7	satisfied
37	1030653	4	4	4	6	4	4	6	4	4	4	4	4	100	12pm	2pm	2	dissatisfied
38	993647	3	4	6	4	5	4	6	5	4	6	4	4	150	3pm	4pm	1	very dissatisfied
39	1032010	4	4	4	4	6	4	4	6	4	4	5	4	100	12pm	3pm	3	dissatisfied
40	1032582	3	4	4	4	6	4	5	4	6	4	4	6	150	12:30pm	3pm	3	dissatisfied
41	1042246	3	4	4	4	5	4	5	7	5	5	7	5	100	12:30pm	9:30pm	9	satisfied
42	758794	3	4	4	4	4	6	5	5	7	5	5	5	100	10:30am	2pm	4	dissatisfied
43	1046352	3	4	4	4	4	4	5	4	6	4	4	4	50	12pm	10pm	10	satisfied
44	858189	5	5	4	6	4	5	5	6	5	4	4	4	100	12pm	2pm	2	dissatisfied
45	529134	3	4	4	4	4	4	4	4	4	7	4	4	50	1pm	1am	12	satisfied
46	1091393	4	4	4	4	3	4	4	6	4	4	4	4	50	1pm	10pm	9	satisfied
47	975947	3	4	4	4	4	4	4	6	3	3	3	4	50	11:45am	8pm	8	satisfied
48	1119360	3	4	4	6	4	5	4	4	7	4	4	4	100	1pm	3pm	2	dissatisfied
49	1079475	3	3	3	3	4	4	4	4	6	4	4	3	50	11am	10pm	11	very satisfied

		ENROLLMENT							ASA		GROUP	Haemoglobin	Total leucocyte count	
50	973250	16-06-2021	40	M	175	80	26	RIGHT TOTAL HIP REPLACEMENT	2	ALCOHOLIC	A	13.8	8.6	148
51	112909	28-Jun	27	M	177	53	16.8	RIGHT TOTAL HIP REPLACEMENT	2	K/C/O THALASSEMIA, ANAEMIA, TCP	A	8.7	2.2	66
52	1130357	01-07-2021	58	F	160	63	25.4	LEFT TOTAL HIP REPLACEMENT	2	HTN	B	10.4	9.3	320
53	1132039	07-07-2021	50	F	162	62	23.5	RIGHT TOTAL HIP REPLACEMENT	2	HTN	B	11.2	7.3	230
54	1132609	07-07-2021	75	F	160	44	19.5	RIGHT TOTAL HIP REPLACEMENT	1	NONE	A	12.6	6.1	197
55	1134211	10-Jul	35	F	152	60	29.3	RIGHT TOTAL HIP REPLACEMENT	1	NONE	A	13.1	12.8	274
56	1136802	16-Jul	82	M	172	70	23.5	LEFT TOTAL HIP REPLACEMENT	3	HTN, ANAEMIA	B	10.9	8.4	204
57	1148761	09-08-2021	19	F	160	55	21.5	RIGHT CC SCREW	1	NONE	B	13.5	7.9	341
58	1141359	10-08-2021	30	M	170	80	27.6	RIGHT TOTAL HIP REPLACEMENT	1	NONE	A	12.1	6.7	144
59	1152463	12-08-2021	57	M	172	82	19.1	RIGHT TOTAL HIP REPLACEMENT	1	NONE	A	13.8	6.1	187
60	1161253	29-08-2021	60	M	170	65	22.4	LEFT TOTAL HIP REPLACEMENT	1	NONE	B	11.5	8.8	130
61	1163787	30-08-2021	34	M	172	70	23.5	LEFT TOTAL HIP REPLACEMENT	2	ALCOHOLIC	A	13.6	4.9	158
62	1164561	31-08-2021	65	M	160	55	21.5	RIGHT HEMIARTHROPLASTY	1	NONE	A	12.9	5	214
63	1165397	14-10-2021	66	F	152	55	23.7	RIGHT HEMIARTHROPLASTY	3	CAD, EF- 32%, SEVERE LV DYSFUNCTION, HTN	A	10.9	6.6	219
64	1188995	06-11-2021	24	M	167	60	21.3	LEFT TOTAL HIP REPLACEMENT	2	BED RIDDEN, RHEUMATOID ARTHRITIS	A	12	6.6	160
65	1209924	20-11-2021	34	M	167	55	19.6	RIGHT TOTAL HIP REPLACEMENT	2	HTN, SPONDYLYTIS	B	12.3	5.8	258
66	1214143	26-11-2021	81	M	174	63	20.5	RIGHT HEMIARTHROPLASTY	3	HTN, DSE+ve	B	11.5	5.2	168
67	1214294	26-11-2021	42	F	159	75	29.3	RIGHT TOTAL HIP REPLACEMENT	1	NONE	A	11.6	11.5	277
68	1215180	28-11-2021	58	M	167	67	23.8	LEFT HEMIARTHROPLASTY	1	NONE	B	13.5	8.8	225
69	1218465	11-12-2021	58	M	164	63	23.1	LEFT TOTAL HIP REPLACEMENT	3	HIV POSITIVE, LOW METS, DERRANGED RFT's	B	10.7	8.9	265
70	562519	25-12-2021	55	F	157	60	24.2	LEFT HEMIARTHROPLASTY	3	EF 25%, SEVERE LV DYSFUNCTION, TCP, DM2	A	10.4	8	80000

		Duration of Anaesthesia in minutes (time from anaesthesia induction to	Duration of surgery in minutes (time from skin incision to	1st VAS recording (on rest) when rescue analgesia was given (out of	1st VAS recording (on dynamic movememt) when rescue analgesia was given (out of	VAS (AT REST)											
50	973250	180	165	5	6	3	3	4	4	5	4	3	3	5	3	4	3
51	112909	120	105	5	6	3	3	3	5	4	5	4	4	5	4	4	4
52	1130357	120	105	5	5	2	3	3	3	4	4	4	4	5	4	3	4
53	1132039	180	165	5	6	3	3	4	3	4	4	4	4	5	3	3	2
54	1132609	150	135	5	7	3	3	4	3	4	5	4	4	6	4	4	4
55	1134211	180	165	6	7	3	2	3	6	3	4	5	4	4	5	4	4
56	1136802	120	105	5	6	3	3	4	3	3	2	3	3	5	3	4	3
57	1148761	120	105	5	6	3	3	4	4	3	4	4	4	5	4	3	4
58	1141359	180	150	6	7	3	4	4	3	4	4	6	5	4	5	4	4
59	1152463	180	150	5	6	3	4	3	4	4	5	4	5	4	4	5	4
60	1161253	120	105	5	5	3	4	3	3	4	4	4	5	4	3	4	4
61	1163787	120	105	6	6	2	3	3	4	4	4	6	5	4	5	3	6
62	1164561	120	105	5	6	3	4	4	4	4	5	4	4	5	4	3	5
63	1165397	120	90	5	5	2	3	3	4	5	4	4	4	5	4	5	4
64	1188995	120	90	5	5	2	3	3	5	4	4	4	6	4	5	4	5
65	1209924	150	120	5	6	5	3	3	4	4	3	4	5	4	4	3	4
66	1214143	135	120	5	6	3	3	3	3	4	4	4	4	5	4	3	3
67	1214294	135	120	5	6	5	4	4	4	4	5	4	6	4	6	4	5
68	1215180	120	90	4	5	3	4	3	3	3	3	3	4	3	3	3	4
69	1218465	120	105	5	6	4	3	3	4	4	4	4	5	4	4	4	5
70	562519	120	105	4	5	3	4	3	3	4	4	3	4	5	4	5	5

		VAS (AT DYNAMIC HIP MOVEMENT)												Total amount of rescue analgesic used in 24 hours	Time of arrival in	Time at which VAS is ≥ 4 for the first time	Duration of analgesia	
50	973250	3	4	4	4	6	4	4	4	6	4	4	4	100	12pm	3pm	3	dissatisfied
51	112909	3	4	3	6	4	6	4	4	6	4	4	4	150	11am	1pm	2	very dissatisfied
52	1130357	2	3	3	3	4	4	4	4	5	4	4	4	50	11am	10pm	12	very satisfied
53	1132039	4	4	4	4	4	4	4	4	6	4	4	3	50	12pm	11pm	11	satisfied
54	1132609	4	4	4	4	4	7	4	4	7	4	4	4	100	11:30am	3:30pm	4	dissatisfied
55	1134211	4	4	4	7	4	4	6	4	4	6	4	4	150	12pm	2pm	2	very dissatisfied
56	1136802	4	4	4	4	4	3	4	4	6	4	4	4	50	4pm	2am	10	satisfied
57	1148761	3	4	4	4	4	3	4	4	6	4	4	4	50	10:45am	10:45pm	12	very satisfied
58	1141359	4	4	4	4	4	4	7	4	4	6	4	4	100	12pm	5pm	5	dissatisfied
59	1152463	4	4	4	4	4	6	4	6	4	4	6	4	150	12pm	4pm	4	very dissatisfied
60	1161253	4	4	4	4	4	4	4	5	4	4	4	4	50	12pm	8:15pm	8	very satisfied
61	1163787	3	4	4	4	4	4	6	5	5	6	4	6	150	11am	4pm	5	dissatisfied
62	1164561	3	4	4	4	4	6	4	5	5	6	4	6	150	11:30am	3pm	3	dissatisfied
63	1165397	3	4	4	4	5	4	4	4	6	4	6	4	150	11am	2pm	3	dissatisfied
64	1188995	3	4	4	5	5	4	4	6	4	4	4	6	150	11am	1pm	2	Dissatisfied
65	1209924	6	4	4	5	4	4	4	6	4	4	4	4	50	11:30am	8pm	9	satisfied
66	1214143	4	4	4	4	4	4	4	4	6	4	4	4	50	11:15am	9pm	10	satisfied
67	1214294	4	4	5	4	4	6	5	7	4	6	4	6	200	12:30pm	4pm	3	very dissatisfied
68	1215180	4	4	4	4	4	4	4	5	4	4	4	4	50	11am	10pm	11	very satisfied
69	1218465	4	4	4	4	5	4	4	6	4	4	4	5	100	11am	7pm	8	Neither satisfied nor dissatisfied
70	562519	4	4	4	4	5	4	4	4	6	4	6	6	200	11am	2pm	3	dissatisfied

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Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 22.01.2021 has approved the plan of thesis of **Dr. Megha Sood,** a student of your college for **MD Anaesthesiology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Efficacy of varying volumes of local anaesthetic solution in pericapsular nerve block on dynamic pain relief after hip surgeries

Supervisor
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The student has to submit the three copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. ***If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.***
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

Doctor of Medicine

in

ANAESTHESIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

NOVEMBER 2019

Dr. MEGHA SOOD

DEPARTMENT OF ANAESTHESIOLOGY
DAYANAND MEDICAL COLLEGE & HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES
For the degree of	M.D. Anaesthesia
Name of candidate	Dr. Megha Sood
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Institution	Dayanand Medical College and Hospital. Ludhiana
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Introduction: Hip fracture is a common orthopaedic emergency in the elderly associated with significant pain. The anterior hip capsule is innervated by the Femoral nerve (FN), Accessory Obturator nerve (AON) and Obturator nerve (ON), and hence these nerves should be the main targets for analgesia. The peri-capsular nerve block (PENG) has reported ability to block the FN, ON and AON at the same time thereby decreasing pain and minimizing the use of opioids in post-operative period for these elderly group of patients. Ultrasound guided nerve blocks should facilitate reduction in local anaesthetic volumes. Hence, we propose to study the efficacy of varying volumes of local anaesthetic solution in PENG block for post-operative pain management in patient undergoing hip surgeries.

Aims & objectives: We aim to evaluate the analgesic effect of varying volumes of 0.2% Ropivacaine used in PENG block, on dynamic post operative pain in patients undergoing hip surgeries.

Material & Methods: A prospective, double blind, randomized study will be conducted on 70 adult patients of ASA- I, II, and III undergoing hip hemiarthroplasty, total hip arthroplasty under general anaesthesia with tracheal intubation (GETA) or general anaesthesia with laryngeal mask airway (GA-LMA), who would be randomly divided into 2 groups A and B to receive either 20ml of 0.2% Ropivacaine or 10ml of 0.2% Ropivacaine respectively in an ultrasound guided (USG) PENG block. The block will be performed under USG using a high frequency curvilinear probe with patient in supine position by an experienced anaesthesiologist after administration of general anaesthesia. Duration of pain relief and VAS scores will be recorded as primary outcome measures, with patient satisfaction scores and cumulative amount of rescue analgesic needed as secondary outcome variables. Data thus collected will be statistically analysed.

Clinical significance: This study will focus to assess the efficacy of varying volumes of local anaesthetic solution in PENG block as an analgesic for hip surgeries.

Keywords: Pericapsular nerve group block (PENG), Femoral nerve (FN), Obturator nerve (ON), Accessory obturator nerve (AON), Post-operative analgesia

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES"** exist in the Department of Anaesthesiology at Dayanand Medical College and Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate herself under our supervision and guidance.

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APPROVAL PROFORMA
BY
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Date of enrollment	6th May, 2019
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PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

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4	DATE OF ADMISSION OF COURSE	6th May 2019
5	TITLE OF THE TOPIC	EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVEBLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Patients having hip fractures are usually elderly with multiple co-morbidities and experience varying intensity of pain necessitating the use of either parenteral or central neuraxial techniques like continuous epidural analgesia for postoperative pain relief.[1] Both these modalities are fraught with adverse side effects like drowsiness or motor block which may adversely affect dynamic pain relief and rehabilitation. Therefore the need for effective postoperative pain control after hip surgeries has led to the development of numerous regional analgesic techniques.

Post-operative pain related to hip surgeries originates around the area of femoral neck and acetabulum. The anterior capsule of hip joint is consistently supplied by three nerves- Femoral nerve (FN), accessory obturator nerve (AON) and Obturator nerve (ON). Femoral nerve and Obturator nerve contribute to 100% innervation whereas accessory Obturator nerve contributes to 54% innervation of the hip capsule.[2] The high articular branches from FN and AON are found between the anterior inferior iliac spines (AIIS) and the iliopubic eminence (IPE) whereas Obturator nerve (ON) lies close to the anteroinferior acetabulum.

Currently, the analgesic options for hip surgeries include femoral nerve block, fascia illiaca block and 3 in 1 nerve block. Fascia illiaca block has been shown to have less adequate pain control, higher narcotic consumption, and more overnight admissions.[1] At best the analgesic effect of these peripheral nerve blocks is moderate because they have variable consistency in blocking the 3 components of lumbar plexus which includes femoral nerve (FN), obturator nerve (ON) and lateral femoral cutaneous nerve.[1] High branches of Femoral nerve originate above the inguinal ligament. Likewise, branches of Obturator nerve originate proximally in the obturator canal. This results in sparing of these nerves during femoral nerve block and 3 in 1 block leading to only a moderate effect on pain in hip fractures.[2] Recent studies have shown that these nerves barely ascend above L5 and the obturator nerve is not accessible for block in its entirety. Therefore, the Obturator and Accessory

obturator nerve (AON) should also be targeted to achieve more effective analgesia.

The newer approach to block the articular branches of Femoral nerve, Accessory obturator nerve and obturator nerve with a single injection at the same time known as the Pericapsular nerve group block (PENG) has a potential to provide adequate pain relief in this group of patients undergoing hip surgeries.[3] The authors used a single injection block of local anaesthetic solution containing 20 ml of 0.25% bupivacaine with 1:400,000 epinephrine in 4 of 5 cases while 1:200,000 epinephrine plus 4mg dexamethasone in one case. They reported quadriceps muscle strength sparing which has a potential to aid in rehabilitation and fast tracking.[3]

The primary measure of any analgesic modality is pain relief which essentially incorporates pain relief at rest and on movement. Dynamic pain relief assumes importance for promoting early rehabilitation and has been defined as ability to breathe deeply and to tolerate physiotherapy with minimum discomfort.[4]

Among the local anaesthetic agents, ropivacaine has been reported to be associated with a lower incidence of motor block than bupivacaine, thereby would further support early mobilization in the post-operative period.[5]

Ueshima and Otake reported use of PENG block for below knee amputation, hip surgeries, and hip dislocation in 3 case reports.[6,7,8] While the authors used 20ml of 0.25% levobupivacaine in the first two surgeries, they reduced the volume of local anaesthetic solution to 10 ml of 1% lidocaine for reduction of dislocated hip.[6,7,8] They observed equi-analgesic efficacy while using varying volumes of local anaesthetic solution. The use of ultrasound (US) guidance can further assist in reducing the volume of local anaesthetic solution while preserving the analgesic efficacy.

Since studies utilising PENG block are few and need further validation in this surgical population, we hypothesised that the use of PENG block in hip surgeries would provide superior pain relief thereby minimizing the requirement of opioids in the postoperative period.

Hence we propose to evaluate the post-operative analgesic duration and efficacy of US guided PENG block when administered using varying volumes of 0.2% ropivacaine, in patients undergoing hip surgeries under General

anaesthesia with tracheal intubation (GETA) or General anaesthesia with Laryngeal Mask Airway (GA-LMA).

6.2 REVIEW OF LITERATURE

Pain is a sensory emotional experience. It originates from external noxious stimuli from the environment that cause a localized sensation in a part of body, to which the individual's response will be to terminate or escape the source of stimulus.[9] Acute post-operative pain and hyperalgesia is associated with peripheral and central sensitizations. In peripheral sensitization, the peripheral small diameter, non-myelinated afferent neurons lower their response threshold, increase the magnitude of response and also increase spontaneous activity. The neurons, A delta and C fibres, are stimulated by inflammatory mediators like hydrogen ions, Noradrenaline, Bradykinin, Potassium ions, Histamine, Prostaglandins, Purines, Cytokines, Leukotrienes, Nerve growth factors and neuropeptides. After peripheral sensitization, impulses are sent to the central nervous system. This is central sensitization, when the transformed pain signals are increased in intensity. Central sensitization occurs when the dorsal horn neurons in the central nervous systems are stimulated by the insult to tissues.

The hip joint is surrounded by a strong and dense capsule which is known to have mechanical, proprioceptive and nociceptive functions.It is recognized that retaining and repairing this capsule during the posterior approach for elective or trauma hip replacement offers greater mechanical stability and a reduced rate of dislocation.[10] Proprioception and nociception of the hip joint are more complex properties regulated by both capsular and extra-capsular structures. Although the role of the capsule and its innervation in proprioception and nociception remains unclear, the principle of soft-tissue preservation is integral to minimally-invasive hip replacement.[11]

The implantation of total/partial hip arthroplasty prosthesis is often accompanied with severe inflammation resulting in high intensity of pain and immediate reduction of this pain might be an important factor in the early recovery process. Poor pain control may lead to major discomfort for the patient and also impaired early immobilization. Immobilization of the patient leads to increased time spent in bed which increases the risk of deep vein thrombosis and resulting prolonged hospital stay. But regular analgesic

agents like opioids and non-steroidal anti-inflammatory drugs do not seem to provide adequate analgesia.

An anatomic study by Short and Baig evaluated the innervation of anterior hip capsule from which vast majority of pain arises. The anterior capsule of hip joint is consistently supplied by three nerves- Femoral nerve, anterior obturator nerve and obturator nerve. Femoral nerve and obturator nerve contribute to 100% innervation whereas anterior obturator nerve contributes to 54% innervation of the hip capsule.[2] Femoral nerve has got high branches i.e. branches above the inguinal ligament. Also obturator nerve has high branches which are branches given proximally in the obturator canal. This therefore explains why femoral nerve block and 3 in 1 block have only a modest effect on pain in hip fractures. This study also identified relations of high branches of femoral nerve and obturator nerve to bony landmarks. High branches of femoral nerve and anterior obturator nerve pass between illio pubic eminence and anterior inferior iliac spine. The high and low branches of obturator nerve are related to acetabulum.[2]

Similarly, a recent anatomical study by Short et al [2] confirmed the innervation of the anterior hip by 3 main nerves i.e. Femoral nerve (FN), Obturator nerve (ON) and Accessory Obturator nerve (AON), but also found that the AON and FN play a greater role in the anterior hip innervation than previously reported. This study also identified the relevant landmarks for those articular branches. The high articular branches from FN and AON are consistently found between the anterior inferior iliac spine (AIIS) and the iliopubic eminence (IPE), whereas the ON is located close to the inferomedial acetabulum.

An anatomical study by Birnbaum K [12] discovered a separation between the anterior and posterior sensory innervation of the hip joint capsule. The anteromedial innervation was determined by the articular branches of the Obturator nerve. Additionally, the anterior hip joint capsule was innervated by sensory articular branches from the femoral nerve. In the posterior part we found articular branches from the Sciatic nerve, which in addition to the articular branches from the nerves to the quadratus femoris muscle, innervate the posteromedial section of the hip joint capsule.[12]

Another study by Wertheimer [13] determined the nerve supply to the ventral aspect of hip joint. It was found that the anterior part is almost constantly

supplied by the articular branch of Obturator nerve (98%). The articular nerves may be of two types- the capsular (penetrating the capsule) and acetabular (penetrating the incisure of the acetabulum. The origin of the articular branches of obturator nerve is proximal to the obturator canal (i.e. in the pelvic cavity) at the level of internal orifice. Also, no direct articular branches from the femoral nerve were found.[13]

In another study by Ernest Gardner [14], the nerve supply of the human hip joint was studied in dissections of adult joints and in serial sections of fetal joints. The articular nerves arise from the femoral, obturator and superior gluteal nerves, from the nerve to the quadratus femoris, from the accessory obturator nerve when present and possibly from branches of lumbar sympathetic ganglia. The branch or branches of the femoral nerve arise either directly from the femoral nerve or from its muscular branches. Most of them supply the iliofemoral ligament, especially near its femoral attachment, and the neighbouring portion of the femur. The articular branch of the obturator nerve supplies the medial portion of the capsule where it ramifies in the fibrous layer of the capsule. When the accessory obturator nerve is present it supplies the area usually reached by the branch of the femoral nerve to the pectineus muscle.

A long recognized simple method for post-operative (Total hip arthroplasty/ hemiarthroplasty) pain management is opioid administered intravenously either as intermittent boluses or as patient controlled analgesia (PCA) infusion. But large doses of opioids are often required which increases the risk of side effects, such as sedation, post-operative delirium, nausea, vomiting, respiratory depression.[1]

A recent Cochrane systematic review comparing various peripheral nerve blocks with no nerve blocks for pain control after elective hip replacement (arthroplasty) surgery in adults, stated reduction in postoperative pain, increased patient satisfaction, and reduction in both postoperative delirium and length of hospital stay in patients receiving peripheral nerve blocks when compared to systemic analgesia.[15]

Epidural analgesia has been widely used for post-operative pain management following total /hemi hip arthroplasty. If only local anaesthetics are

administered epidurally, there is a risk of motor blockade and difficulty in mobilizing the patient. Epidural anaesthesia with an indwelling catheter prolongs pain relief, but can lead to serious and rare complications such as epidural hematoma, nerve damage, catheter displacement or epidural infection.[1]

A study by Jason J Shin[1] studied the analgesia options after hip surgeries. Femoral nerve block, Fascia illiaca block and lumber plexus blocks were studied. It was therefore found out that nerve blocks although modestly effective, must be used with caution to decrease risk of falls postoperatively. Based on this study[1] patients who receive Fascia illiaca block have less adequate pain control, higher narcotic consumption, and more overnight admissions. Fascia illiaca block anesthetizes femoral and lateral femoral cutaneous nerves and is thought to achieve comprehensive anaesthesia of the lateral and anterior aspect of the thigh. However, the medial, posterior, and lateral aspects of the capsule, which are innervated by nerves that originate from the sacral plexus, are not contained within the fascia illiaca compartment, and this lack of coverage may explain in part why this block does not achieve better pain control. Unlike the Fascia illiaca block, which works by diffusion of anaesthetic agents under the iliacus fascia to anesthetize the femoral and lateral femoral cutaneous nerves, the Lumbar plexus block targets these nerves as well as the obturator and accessory femoral nerves at their origins for more complete coverage. But epidural spread remains a common complication of Lumbar plexus block and can further result in motor block leading to falls and urinary retention.[1]

Recently, Giron et al[3] described a new technique for regional anaesthesia intended for pain control in hip fractures. This ultrasound- guided technique, named by the authors as the PENG (Pericapsular Nerve Group) block, includes the blockade of sensitive branches of the FN and AON in a single-injection. PENG block was performed on 5 patients following a discussion of the potential risks and benefits. The authors used a single injection block of local anaesthetic solution containing 20 ml of 0.25% bupivacaine with 1:400,000 epinephrine in 4 of 5 cases while 1:200,000 epinephrine plus 4mg dexamethasone in one case. Thirty minutes after the block placement, they

evaluated all patients by asking them to flex at the hip. All patients were able to comply and reported significantly reduced pain scores compared with baseline. In addition, no quadriceps weakness was clinically evident in any of the patients.

A recent anatomical study showed that the articular branches from the FN to the hip joint enter the iliacus muscle at the L4–L5 level and course deep to the psoas muscle and tendon between the AIIS and IPE before innervating the hip capsule. The AON courses deep to the medial aspect of psoas muscle around the L5 level. It then courses deep to the psoas around IPE to enter the anteromedial joint capsule. Therefore, neither the 3-in-1 nor the Fascia illiaca block is likely to consistently block the articular branches from the AON and FN.[1]

In a case series by Ueshima H and Otake H stated that the combination of pericapsular nerve block and popliteal block is an effective analgesic for below knee amputations.[6] The same group of authors also reported efficacy of PENG block as an analgesic for hip surgeries and dislocation of hip joint. [7,8] While the authors used 20ml of 0.25% levobupivacaine for below knee amputation and hip surgeries [6,7] they reduced the volume of local anaesthetic solution to 10 ml of 1% lidocaine for reduction of dislocated hip [8] and observed similar analgesic effect in all these case scenarios.

Taken together, these studies suggest that, PENG is an effective post-operative analgesia for hip surgeries as it has reported ability to block the femoral, obturator and accessory obturator nerve at the same time thereby decreasing pain and minimizing the use of opioids in post-operative period. Hence, we propose to evaluate the post-operative analgesic duration and efficacy of US guided PENG block when administered using varying volumes of 0.2% ropivacaine, in patients undergoing hip surgeries under General anaesthesia with tracheal intubation (GETA) or General anaesthesia with Laryngeal Mask Airway (GA-LMA).

6.3 AIMS AND OBJECTIVES OF THE STUDY

To comparatively evaluate the analgesic efficacy of varying volumes of local anaesthetic solution on dynamic post-operative pain after PENG block in patient undergoing hip surgeries.

7. MATERIALS AND METHODS

7.1 SOURCE OF DATA

A randomized double blind observational study will be conducted in the department of Anaesthesiology, Dayanand Medical College &Hospital, Ludhiana after approval by Institutional Ethics Committee on a total of 100 adult patients undergoing hip hemiarthroplasty or total hip arthroplasty under general anaesthesia with tracheal intubation (GETA) or General anaesthesia with Laryngeal Mask Airway (GA-LMA) who would be randomly allocated to either of the 2 study groups of 35 patients each by computed generated randomization codes contained in sealed, sequentially numbered envelopes. A written informed consent will be obtained from each patient

7.2 METHOD OF COLLECTION OF DATA

Inclusion criteria:

- Patients scheduled for hip surgeries i.e. hip hemiarthroplasty, total hip arthroplasty, Dynamic hip screws (DHS) under GETA or general anaesthesia with Laryngeal Mask Airway (LMA)
- ASA I, II& III patients
- Cognitive ability to comprehend VAS scale

Exclusion criteria:

- Frank coagulopathy evidenced by history and laboratory investigations
- Infection at injection site
- Allergy to local anaesthetic drugs
- Patients receiving spinal/CSE block for hip surgeries
- ASA IV patients
- Patients on chronic opioid abuse
- Diabetic neuropathy
- Use of opioids for chronic analgesia

GROUP ALLOCATION:

Approximately 70 patients will be recruited for the study to account for dropouts and an equal number of patients will be allocated randomly using computer generated random number list to either of the 2 groups:

GROUP A:

Comprising of 35 patients who will receive local anaesthetic solution of 10 ml of 0.2% Ropivacaine constituted in a 20 ml syringe.

GROUP B:

Comprising of 35 patients each who will receive local anaesthetic solution of 20ml of 0.2% Ropivacaine in a 20ml syringe.

All syringes would be labelled as study drug and wrapped with sterile adhesive tape after drawing the local anaesthetic solution as per group allocation, to maintain blinding.

The randomization scheme using computer generated random number will be prepared by our biostatistician and those involved in the study would be unaware of the group allocation. The allocation envelope will be opened by an anaesthesiologist who would not be involved with the direct clinical care of the patient. This anaesthesiologist shall prepare the local anaesthetic solution as per random allocation sequence and hand the sterile study drug syringes to the senior anaesthesiologist performing the PENG block. A blinded observer will assess preoperative and postoperative pain scores. This observer will not be involved in the direct clinical care of the patient. These codes would be decoded at the end of study period.

PRE ANAESTHETIC CHECKUP

Routine thorough check up will be conducted comprising of detailed history, comorbidities, allergy to any drug being used, general physical and systemic examination. Patients will be explained about the study being conducted and written informed consent will be taken and also educated on the use of VAS scale. Relevant investigations will be sent and reviewed.

Preoperative VAS at rest and on dynamic movement will be noted prior to shifting the patient into the operating room (OR) in the preoperative holding area. Demographic information including BMI, age and sex, type of hip surgeries will be recorded.

ANAESTHESIA TECHNIQUE

On arrival in the OR, patients will be positioned on the operating table in the supine position and routine monitoring in the form of 5-lead electrocardiography, non-invasive blood pressure (NIBP), temperature and

pulse oximeter and end tidal CO_2 ($EtCO_2$) will be instituted. Heart rate (HR) will be recorded using 5 lead electrocardiography and non-invasive blood pressure (NIBP) using an automated non-invasive device that will be recycled every 1 min until three consecutive measurements of systolic blood pressure (SBP) are recorded and mean of three readings will be recorded as baseline. General anaesthesia with tracheal intubation (GETA) of general anaesthesia with laryngeal mask airway (GA-LMA) will be administered using a standard uniform induction and maintenance technique. Injection Fentanyl 1-2 mcg/kg, and injection dexamethasone 8mg i/v will be administered at the time of anaesthesia induction in all patients.

PENG block will be performed under USG guidance after anaesthesia induction and securing of airway has been accomplished. A curvilinear low frequency (2-5 MHz) ultrasound probe will be initially placed in a transverse plane over the Antero inferior iliac spine (AIIS) and then aligned with the pubic ramus by rotating the probe counter clockwise approximately 45 degrees. In this view, the Illiopubic eminence, the iliopsoas muscle and tendon, the femoral artery, and pectineus muscle will be visualised. A 20-gauge, 100 cm stimuplex ultra 360 (B BRAUN) needle will be inserted from lateral to medial direction in an in-plane approach, to place the tip of the needle in the musculofascial plane between the psoas tendon anteriorly and the pubic ramus posteriorly. Following negative aspiration, the study drug will be injected slowly while observing for adequate fluid spread in this plane.[16] Both the patient and the observer will be blinded to the nature of study drug being used. Intraoperative supplemental fentanyl shall be administered at the discretion of the attending anaesthesiologist and recorded.

Surgery shall be initiated after institution of the PENG block and standard uniform technique for extubation shall also be followed in all patients at the end of the surgery. Additional parenteral IV analgesics will not be administered towards the end of the procedure.

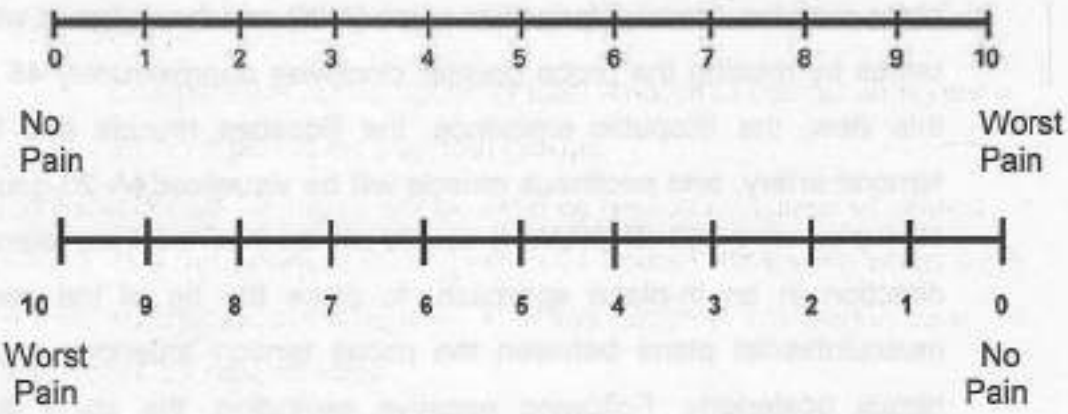
FOLLOWING OUTCOMES WILL BE OBSERVED POSTOPERATIVELY:

PRIMARY OUTCOME:

To evaluate the analgesic efficacy of varying volumes of local anaesthetic solution on dynamic pain after PENG block in postoperative period. This shall be evaluated using the following:

- Duration of analgesia- Duration of analgesia will be defined as the time from shifting the patient to post anaesthesia care unit (PACU) to the time of first requirement of rescue analgesic at VAS ≥4.
- Visual analogue scale (VAS) will be recorded preoperatively i.e prior to block administration in the preoperative holding area and then postoperatively every hourly for the first 4 hours and then 2 hourly for next 2 hours and then 4 hourly till 24 hours. VAS shall be observed at rest and on dynamic movement at each point in time. Dynamic hip movement will be achieved by asking the patients to flex at the hip and to perform a straight leg raise of the affected limb to 15 degrees.[3]

The score will be determined by asking the patient to rate the pain from 0-10, where in 0 being the least pain and 10 being the maximum.

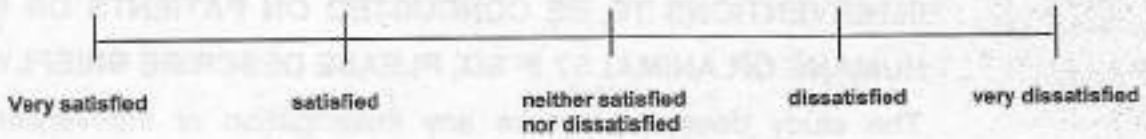


SECONDARY OUTCOMES:

- Comparative consumption of total amount of rescue analgesic in 24 hour period among both groups.

Injection tramadol 50-100mg i/v will be used as rescue analgesic whenever the VAS ≥ 4, to a maximum of 400mg within 24 hours [17] following which if still VAS>4 then another rescue analgesic, injection Fentanyl 1mcg/kg i/v as a slow bolus shall be administered.

- Patient satisfaction score will be measured by asking the patient to rate their satisfaction on a 5-point Likert scale 24 hours after surgery in PACU prior to shifting them to their respective ward.



STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups will be done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test will be performed and Fischer exact test will be used when the expected frequency would be less than 5. A probability value (p value)less than 0.05 will be considered statistically significant. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

SAMPLE SIZE CALCULATION

It is assumed that the prevalence rate of hip surgeries in our hospital is 4.2% based on previous data.

Assumptions:

Confidence Level = 95%

Precision (d) = ± 5%

For estimation of sample size, the following formula has been used

$n = (Z^2\alpha \times P \times (1-P))/d^2$

Where;

$Z\alpha$ = Value of standard normal variate corresponding to α level of significance

P = Likely value of parameter

Q = 1 – P

d = Margin of errors which is a measure of precision

With these assumptions a sample size of 62 patients would be included in the study. In addition, accounting for a 10% drop out rate we propose a sample size of 70 patients for our study.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

The study does not require any investigation or intervention other than those routinely done for every patient hip surgeries.

7.4 HAS ETHICAL CLEARENCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3 ?

Attached here with.

8. LIST OF REFERENCES

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PROFORMA

Randomization code:

Enrollment date: CR No: Sr No:

Age: Gender:

Height: Weight: BMI:

Type of hip surgery:

ASA grade: Comorbidities:

INVESTIGATIONS:

Investigation	**Date**	**Value**
Haemoglobin (Hb)		
Total leucocyte count (TLC)		
Platelets		

- **Duration of Anaesthesia in minutes (time from anaesthesia induction to uneventful extubation): _____**
- **Time of institution of block: _____**
- **Duration of surgery in minutes (time from skin incision to closure): _____**

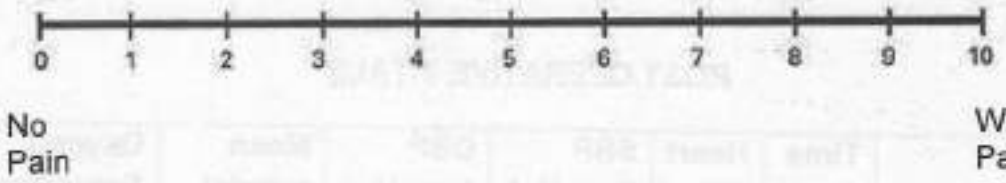
Signature of Candidate **Signature of Supervisor**

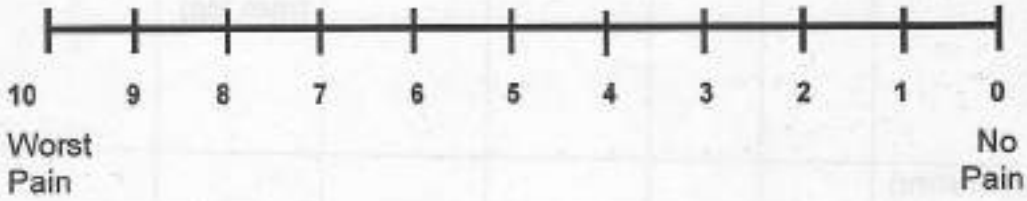
POST OPERATIVE OBSERVATIONS

Time since PENG block given	Time	VAS (at rest)	VAS (on dynamic movement)	Time of first rescue analgesic given	Amount of rescue analgesic given (also mention the name of rescue analgesic)
Baseline(preoperative)					
0 min (on arrival in post anaesthesia care unit (PACU)					
1hr					
2hr					
3hr					
4 hr					
6hr					
8hr					
12hr					
16hr					
20hr					
24 hr					

Signature of Candidate

Signature of Supervisor





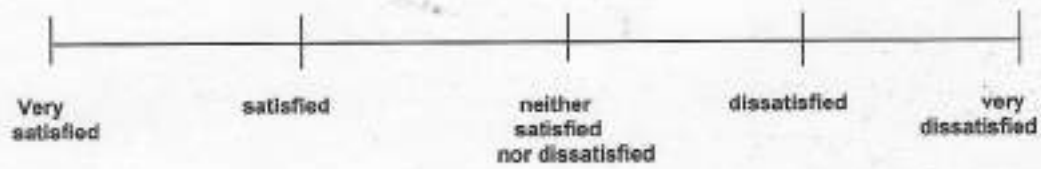
- **Total amount of rescue analgesic used in 24 hours period: _____ mg**

- **Time at which VAS is ≥ 4 for the first time post-operatively: _____**

- **Duration of analgesia: _____**

Overall patient satisfaction:

- ☐ very satisfied
- ☐ satisfied
- ☐ neither satisfied nor dissatisfied
- ☐ dissatisfied
- ☐ very dissatisfied



Signature of Candidate **Signature of Supervisor**

POST OPERATIVE VITALS

Time	Time	Heart rate	SBP (mm Hg)	DBP (mm Hg)	Mean arterial pressure (mm Hg)	Oxygen Saturation (%)	Respiratory rate (per minute)
Baseline(preoperative)							
0 min (on arrival in post anaesthesia care unit (PACU)							
1hr							
2hr							
3hr							
4 hr							
6 hr							
8hr							
12hr							
16hr							
20hr							
24 hr							

Signature of Candidate

Signature of Supervisor

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

.....am willing to participate in the study **"EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Supervisor

Signature of Candidate

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"EFFICACY OF VARYING VOLUMES OF LOCAL ANAESTHETIC SOLUTION IN PERICAPSULAR NERVE BLOCK ON DYNAMIC PAIN RELIEF AFTER HIP SURGERIES" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

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ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

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ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

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ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ